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DRY-ROT OF SWEDES AND TURNIPS.

SEED SHOWN TO BE PRIME CARRIER OF THE DISEASE.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

[*The following abridged article has been prepared for the Journal by Dr. Cunningham from a technical bulletin treating fully his investigation and conclusions on this disease, which has just been issued by the Department of Agriculture under the title "Dry-rot of Swedes and Turnips: Its Cause and Control."—Ed.*]

DRY-ROT is to-day the most serious disease attacking swedes in New Zealand, for in a season favourable to its spread it may destroy from 50 to 100 per cent. of the crop. On turnips its effects are generally much less severe, but even with this host the loss may amount up to 40 per cent. Infected bulbs become a total loss; consequently the direct loss from this disease is much greater than is first apparent, for loss of the greater part of the swede crop seriously affects the carrying-capacity of the farm.

Appearance and Effect on the Hosts:

The appearance of the disease varies considerably according to the part of the plant attacked; therefore this will be considered in relation to each part.

Leaves: Small circular spots, slightly sunken below the surface, tobacco-brown or ashy-grey in colour, appear on leaves, first becoming noticeable on the cotyledons, and present thereafter until maturation of the bulb. In these spots small black bodies, the fruiting structures of the causal organism (termed pycnidia), soon make their appearance. These bodies are frequently arranged in concentric circles.

Bulbs: Early infection of the bulb occurs in the region of the neck, and on account of frequently being hidden beneath the leaves the lesions are often overlooked. The lesions produced are at first small and leaf-green in colour; they soon become slightly sunken, and turn grey or brown. In small bulbs the disease soon spreads through the tissues, causing death of the bulb. At this stage the lesions are few, but often of considerable size. Later they become more numerous and are often scattered over the whole surface of the bulb, though rarely below ground-level. They do not penetrate so deeply into the flesh; consequently, though more numerous, they seldom kill the plant outright until later in the season, when the lesions tend to merge one with

another. Such a condition is followed by death of the bulb; it does not tend to rot, however, as do those infected earlier in the season, but dries out and assumes a "mummied" appearance. The appearance of the disease is frequently masked by the presence of another pathogen, which sets up a soft rot.

Pycnidia are often abundant in lesions on bulbs, but are by no means characteristic, as they are just as frequently absent.

Stems: On stems of cabbages and flowering-spikes of swedes and turnips are produced lesions brown or grey in colour. On cabbages infection is frequently followed by death of the plant, but on spikes small depressed areas only are produced, the spike rarely being killed unless the lesions are very numerous.

Siliquas: On the siliquas (seed-pods) characteristic brown or ashy-grey lesions are found. In the interior of the pod a flocculent mycelium is often present, extending to and surrounding seeds in the vicinity of the lesions. The significance of this seed-infection will be made clear later in this article.

Life-history of the Causal Organism.

Dry-rot is caused by the fungus *Phoma lingam*. In New Zealand it has hitherto commonly been attributed to *Phoma Napobrassicae*, but in his technical bulletin the writer has shown this to be a synonym of the former. *Phoma lingam* has been found in the Dominion on swede and turnip bulbs, leaves, spikes, siliquas, and seed; and on leaves and stems of cabbage, but not on kohl rabi, chou moellier, rape, or wild turnip, nor other weeds belonging to the family Brassicae.

Experiments conducted in this Laboratory have proved that the disease is perpetuated by means of resting mycelium in the seed-coat. When the seed germinates this structure (termed the testa) is frequently carried upwards on the tips of the cotyledons. Before the latter expand the fungus grows out from the testa into the cotyledon tips, there producing a small lesion (brown in colour, and therefore readily noticeable) on one or both cotyledons. This lesion is formed by the hyphæ of the fungus penetrating into and destroying the cells of the leaf. These turn brown and die, and among them knots of hyphæ are produced which eventually take the form of flask-shaped receptacles or pycnidia.

In the pycnidia very many one-celled colourless spores are produced. The pycnidium, as has been shown, is embedded in the tissues of the leaf, and opens to the exterior by means of a small apical pore (termed an ostiolum). The spores are embedded within the pycnidium in a mucilaginous matrix, which is strongly hygroscopic—that is, it has a strong attraction for water. Consequently in wet or humid weather the mucilage absorbs water to such an extent that it swells and is forced through the apical pore of the pycnidium as a small gelatinous tendril, carrying with it the embedded spores. In this manner spore-discharge occurs, but as such is possible only in the presence of abundant moisture it will be seen that discharge is possible only during wet or humid weather, and cannot occur during dry weather. The tendril is soluble in excess water; consequently in wet weather it becomes of a liquid nature, and is washed down the leaf or spattered in rain-drops

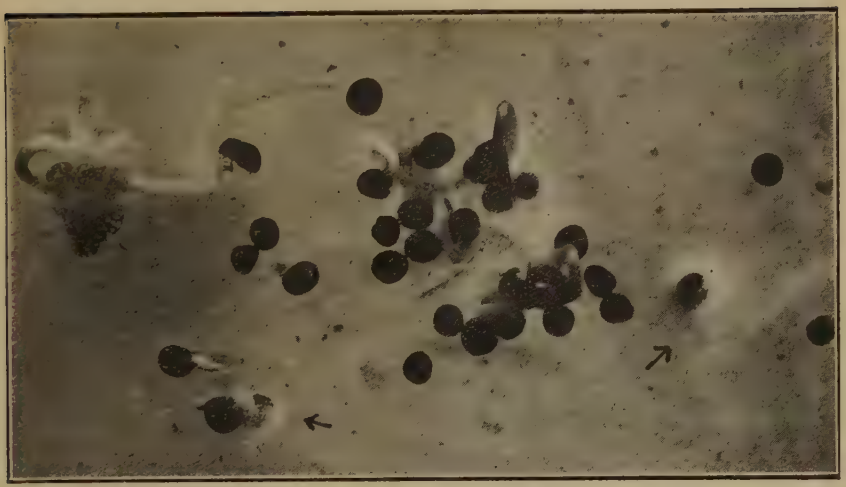

FIG. 1. DRY-ROT FUNGUS (INDICATED BY ARROWS) GROWING FROM SEEDS TO CULTURE MEDIA THREE DAYS AFTER PLATING. × 5.

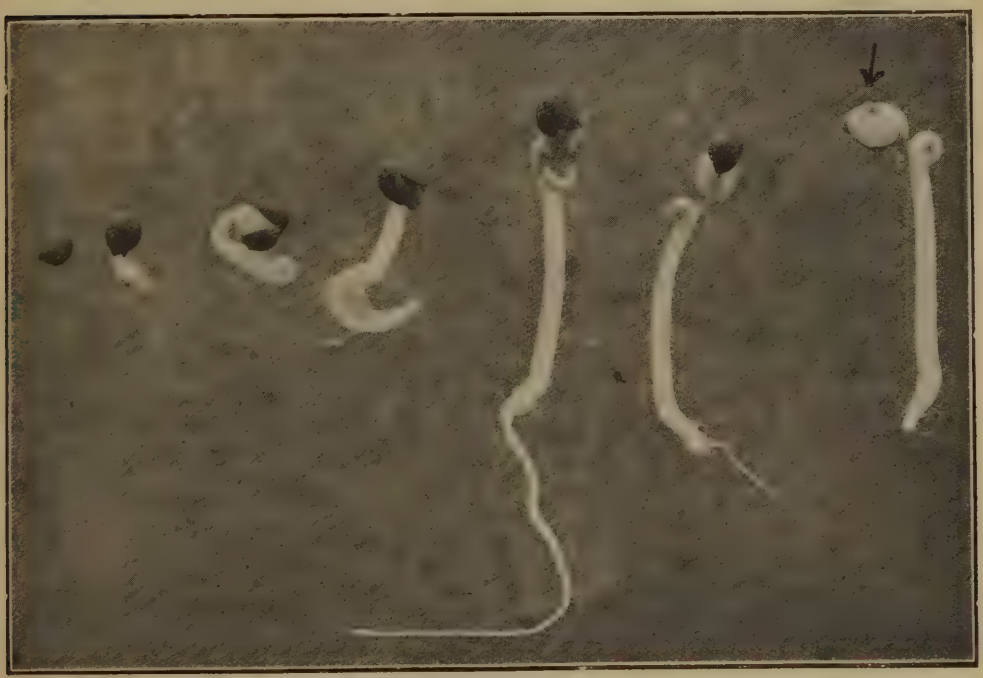

FIG. 2. GERMINATING SWEDE-SEEDLINGS, SHOWING MANNER IN WHICH TESTAS (SEED-COATS) ARE CARRIED UPWARDS ON THE COTYLEDON TIPS. × 2.

Arrow points to dry-rot lesion on cotyledon of plant on the right.

[Photos by H. Drake.

to leaves of contiguous plants, each drop carrying very numerous spores. If a dry spell prevails, the spore tendril dries out and becomes firmly fixed to the surface of the leaf (or bulb, as the case may be); consequently, until moisture is again present, spore-dispersion is not possible. Spores may remain alive in dried mucilage for over six weeks, but if the mucilage is removed they live for only five to ten days or less.

It will thus be seen that the disease is carried to the field in the seed, and therefore that diseased seedlings will be present in the field a fortnight or less after sowing, their number varying according to the proportion of disease present in the seed. This proportion varies greatly, in some lines being about one infected seed in a thousand, in others as high as five seeds per hundred. If dry conditions are met with after sowing, or if the seed is sown late in the season (say, January), the probability is that these initial infection sources are considerably lessened, and possibly in extreme cases eliminated.

FIG. 3. SEEDLING LEAF OF SWEDE TWELVE DAYS AFTER GERMINATION, SHOWING LESION PRODUCED BY THE DRY-ROT ORGANISM. × 5.

[*Photo by H. Drake.*

The fungus spreads by means of the spores to other leaves of the same plant, and to other plants in the vicinity. Apart from forming lesions on the leaves it does little damage, however, for as yet no bulbs are formed. Further, it has been found that at this stage the disease seldom spreads beyond the initially infected plant, or beyond those in its immediate vicinity.

Such a condition prevails until from six to eight weeks after sowing -until, in fact, the bulb has begun to develop. At this stage dry-rot lesions become noticeable owing to death of occasional plants in the field, these showing rapid wilt and discoloration of the leaves. The crowns of such plants are completely rotted, although the bulbs may be quite healthy. Infection of these individual plants occurs from spores being washed from the leaves by way of the channels on the upper surfaces of the leaf-stalks to the crown. In the lesion thus produced numerous pycnidia are formed, and from these, during moist weather, spore tendrils are produced. These bulbs serve as the chief means whereby the disease carries over the earlier parts of the season, for the fungus can live in the bulb-tissues for several weeks, and, whenever the weather conditions are moist, during the whole of this period is capable of producing spores. These, as has been shown, are

embedded in mucilage. Now, as leaf-motion in the field is constant, leaves frequently brush these tendrils and in turn become infected; or the tendrils may thus be carried on to other surfaces and spores washed to the crowns of contiguous plants by rain The significance of this primary bulb-infection is that infection centres, capable of infecting over a considerable period, are established over the field.

From these centres the disease spreads to contiguous plants in the rows, so that within a few weeks after scattered infected plants have

FIG. 4. LESION PRODUCED BY THE DRY-ROT ORGANISM IN SWEDE-LEAF. × 10.

The black bodies are the pycnidia.

[*Photo by H. Drake.*

become noticeable others in their vicinity show lesions, and in turn rot. It must be stressed that infection in the field is possible only where spores are brought into contact with the leaf or bulb. Such contact is effected by means of the leaves or by the spores (embedded in mucilage) being splashed to other plants in rain-drops. That is why infected plants at this or a later stage occur in the nature of small irregularly circular areas, and not simultaneously over the field. Wind plays only an indirect part in spore-dispersion—that is, by

moving the leaves about, or in blowing drops of rain containing spores to contiguous plants. It follows, therefore, that if one field is separated from another by a road or similar gap, the disease cannot be transmitted across such a gap, provided insects, animals, or cultural implements do not carry the disease from diseased to healthy plants across the intervening space. And as moisture is essential to spore-production, this explains why the disease is more severe in wet seasons or in wet or low-lying areas in the field; for under such conditions spore-production is continuous and infection can occur almost continuously. Conversely, dry-weather conditions inhibit infection; so that in certain localities of New Zealand, and in certain seasons throughout, little or no dry-rot is present.

From the small initial infection areas the disease gradually spreads outwards, so that frequently these infected areas merge and their individuality is lost. Should wet-weather conditions prevail, the disease may in the course of two or three months spread throughout the whole field; in fact, in the South it is not unusual to find in a season favourable to dry-rot 80 per cent., or even more, of the crop affected.

Initial bulb-infection is invariably followed by death of the plant. This is due to the fact that the diameter of the bulb is small and the lesion quickly destroys all tissues in its vicinity. Later, as the bulbs become considerably larger, the number of lesions present may be large, but each may penetrate to a slight extent only, so that the bulb, although with numerous lesions, may not decay for several months. Complete decay of large bulbs, as a rule, occurs only towards the end of the season, when they may dry out and assume a mummied appearance. Such mummied bulbs are a possible source of infection the following season, for unless they are buried they may lie on the ground (even when ploughed, as the cultural implements frequently bring them to the surface) until the next crop has appeared. This applies generally only when a crop has been fed off late (as in September) and a second crop of the same host sown early (as in November). The writer has shown in his bulletin that the disease may persist in these mummied bulbs for several months, but cannot persist in the soil in any other form.

Leaf-infection occurs of necessity first in the life-cycle of dry-rot. Later, when the bulbs are formed, bulb-infection is the more common; but at all stages leaf lesions may be found. Lesions develop chiefly on the neck and crown of the bulb, less commonly on the side (save where much exposed), and very seldom at or below ground-level. The explanation of this is that most of the spores are distributed by leaf-contact first with diseased plants, then to the healthy leaves or bulbs. The rarity of ground-level infection shows that seldom are the spores carried to this part, and this can be explained when the shape of the average bulb is considered. As has been shown, spores are washed down from the leaves to the crown and neck of the bulb, or deposited on the neck and crown directly by leaf-contact. If a bulb is normally upright the shoulder prevents the spores being washed to the lower portion; if, on the other hand, the bulb is inclined, the shoulder is no longer a protection, and heavy infection may result. Infections at or below ground-level are, of course, merely accidental,

FIG. 5. NECK-INFECTION OF SWEDE-BULB. NATURAL SIZE.
Note the complete destruction of all tissues in this region.
[*Photo by H. Drake.*

on account of their rarity; they occur merely through spores being deposited on the bulb at this point, those below ground-level occurring only when the soil has been forced away from the bulb, such as happens occasionally when the bulb has been moved by wind or by animals.

It has been shown that the disease is carried in the seed. It is now necessary to explain the manner in which the seed becomes

infected; and this has been facilitated by the liberal manner in which Mr. C. W. Body, of Kelso, Otago, has allowed us to make use of material from his swede-seed area.

FIG. 6. DRY-ROT INFECTION ON SWEDE SEED-PODS. NATURAL SIZE.

Seed removed from beneath these lesions produced typical dry-rot colonies on culture media.

[*Photo by H. Drake.*

The disease becomes established in bulbs to be used for seed in the usual manner. When the seed-spike develops, its leaves become infected, and the disease spreads from these to the spike. On both are produced abundant lesions, from which spores are produced. As the seed-pods develop, spores are carried to these, the fungus penetrates

FIG. 7. LESION PRODUCED IN SWEDE-BULB AS A RESULT OF EARLY INFECTION HALF NATURAL SIZE.

[*Photo by E. B. Levy.*

the pod and establishes an infection centre. From this the hyphæ of the fungus grow into the pod, and partially surround the seeds contained therein. The hyphæ grow directly into the seed-coat, and remain there in a quiescent condition until the seed has germinated, when, as has been shown, the fungus grows out from the seed-coat into the cotyledons, there producing lesions from which initial infections of the crop arise. The fungus may remain in a dormant condition in the seed for a considerable period—two or three seasons—but not indefinitely, for it has been established in this Laboratory that it tends to disappear from the seed after long keeping. For example, last season a line of 1926 seed harvested in 1925, containing 5 per cent. of diseased seed, was used extensively in experimental work. This season part of the same line was again used, and was found to contain only 0·1 per cent. diseased seed. This fact– that the disease cannot live indefinitely in the host––is already known with several other seed-carried diseases. It cannot be made use of in commercial control, however, as to keep a line sufficiently long for the disease to disappear would prove expensive, in that the germination percentage of the seed drops considerably each season. For example, the line with 5 per cent. of diseased seed last season gave a germination average of 85 per cent.; this season the germination had fallen to 54 per cent. It is not considered necessary to give here the process elaborated for detecting the presence of the disease in a line of seed; this has been dealt with fully in the bulletin.

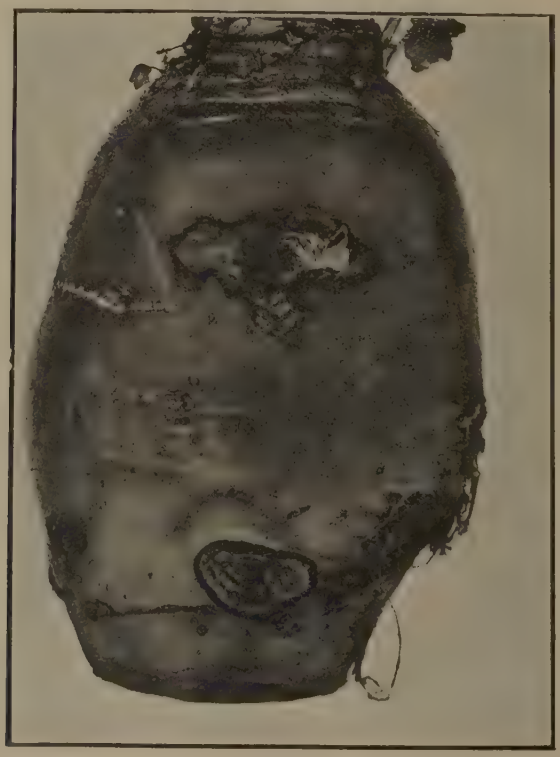

FIG. 8.

FIG. 9.

FIG. 10.

FIGS. 8, 9, 10. DIFFERENT TYPES OF LESIONS PRODUCED ON SWEDE-BULBS. HALF NATURAL SIZE.

[Photos by H. Drake.

Methods of Control of Dry-rot.

As dry-rot is seed-borne, it naturally follows that some method of treating the seed so as to destroy the fungus without affecting seed-germination would be the efficient method of combating it. Therefore a comprehensive series of experiments was conducted with the object of finding some such treatment. In these experiments it was found that the standard treatments for externally borne diseases were quite ineffective; and also that the standard methods for internal seed-borne diseases were equally ineffective. Finally, the following original method was found completely to eliminate the disease without material damage to the seed, *always provided this was initially of high-germination capacity*:—

Treatment: Half fill small cloth bags holding 2 lb. of seed or less; immerse these for one hour in a 0·25-per-cent. solution of Semesan held at 115° F. Ensure that seed is properly covered with the solution during this period. Remove bags, drain off surplus water, and spread seed in thin layers to dry (preferably on blotting-paper in a sunny place); or dry by passing through the seed (spread out in thin layers on cheese-cloth) a current of air heated to about 80° F.

In addition to using disease-free seed, or seed which has been treated so as to destroy the fungus, it is necessary that such be sown on land which has not been under swedes, turnips, or cabbages for twelve months. For, as has been shown, mummied bulbs may carry the disease for sufficiently long a period to cause infection of the following season's crop.

In numerous field experiments conducted during the past season it was found that the treated seed used did not suffer appreciably as a result of the treatment specified above, and in many of the crops the treatment appeared to have a decidedly stimulating effect. Further, the treatment proved quite satisfactory as a controllant of the disease where extraneous sources of infection were eliminated.

Unfortunately, it is not practicable under present conditions to treat the swede and turnip seed coming into New Zealand so as to free it from disease, for it has been found that, unless the initial germination of the seed is high, serious depreciation in germination follows treatment. Consequently, with the great bulk of seed coming into the Dominion, treatment would seriously affect germination, as the germination of the average line is not of the first order. Another factor operating against bulk treatment is the present method of handling seed. A number of lines are forwarded in sealed 1 lb. or 2 lb. bags. To open these, treat the seed, rebag, and reseal would entail an enormous amount of work, necessitating the employment of a considerable staff. And to treat the bulk seed would require the erection of a large plant and the employment of highly skilled specialists.

These factors, together with others of a technical nature—which need not be enumerated here—make it appear more reasonable to employ some other method of elimination of the disease from the seed. Two other and more practicable methods are open to consideration.

One of these is to eliminate the disease from the seed before it comes to this country; the other, to grow in New Zealand disease-free seed.

To eliminate the disease from the seed before it comes to New Zealand seems to be, for the time at least, the more reasonable method, as then use could be made of the available machinery for distribution, and competition with the British seedsmen avoided. If swede- and turnip-seed growing were practised in the Dominion (and there is nothing to prevent its being a success under proper management) competition with seedsmen and merchants would be inevitable—a condition which could be met only by legislation.

FIG. 11. SECTION OF PYCNIDIUM OF THE CAUSAL ORGANISM. × 125.

[*Photo by Writer.*

In Britain (which supplies all but a few hundredweight of our annual requirements) most of the bulk seed is grown by farmers under contract to the seedsmen. The latter supply pedigree seed, raised for the most part on their own farms from selected bulbs, to the growers, who in turn sow it either directly in the fields, or else first sow in seed-beds or boxes and transplant the seedlings when they have reached a stage when the bulb is about the thickness of a lead-pencil. Sowing or transplanting is carried out in early autumn (August), and the crop harvested about twelve months later. The seed-spikes are cut and handled just as are oats or wheat, and, when dry, are stacked in long ricks until ready for threshing. A good average yield of turnip-seed is about 1,800 lb. per acre. Now, as we imported 564,480 lb. of swede and turnip seed in 1926, a rough calculation will show that to produce this amount, with an average

yield of 1,500 lb. per acre, 375 lb. of seed (here termed "mother seed") would require to be sown. To treat this amount would prove a relatively simple matter; and, what is of greater moment, even were germination reduced by 50 per cent., the loss incurred would be slight compared with the same loss were the bulk seed treated. One other point of interest is worthy of mention here. The seed coming to New Zealand is at least one year old before it reaches the farmer; consequently, unless of the finest quality, its germination will have been reduced by keeping by from 5 to 15 per cent. Such seed, if treated, may suffer considerable reduction in germination here because of this initial reduction, but would suffer little damage if treated twelve months previously.

Thus, if the seedsmen in Britain were to treat their "mother seed" before it was issued to the contract growers, and if they were in addition to ensure that such was grown on land which had not been under brassicas for twelve months previously, a clean crop would result; for, as has been shown, infection can occur only from contiguous diseased plants, the spores of the fungus not being wind-borne. A clean crop would result in the seed being free from the disease, would result in increased seed-yields, and would eliminate the necessity for our taking any further steps in New Zealand (apart from ordinary farm-management) to deal with dry-rot.

Were such practices adopted in Britain, in a season or two dry-rot might be entirely eliminated from the swede and turnip crops of New Zealand. It appears (to the writer at least) reasonable that this method of fighting dry-rot should be given a fair trial, as then the British seedsmen, who have worked so long to produce the fine strains of swedes and turnips of to-day, would, if they adopted the methods outlined, suffer no appreciable loss, but would benefit in material increase in yields, and particularly in retaining the New Zealand trade. If, on the other hand, growing the seed in New Zealand were resorted to, and clean seed produced, it would be necessary to protect such a developing industry, and prevent the introduction into the Dominion of diseased seed by legislating against the importation of any lines carrying the disease. It would not be possible to enforce such legislation until the machinery for growing and distributing such seed were in operation—a matter requiring several years at least—otherwise we should be faced with a seed famine, for, judging by the samples of 1926 seed tested, few lines would gain admittance were such measures enforced.

Finally, it should be noted by the farmer that on being supplied with clean seed it would be necessary for him to undertake certain simple precautions. These are—

(1) To abstain from sowing swedes or turnips on land which was in a similar crop the previous season.

(2) To clear absolutely all previous season's seed from his drills, &c.

(3) To destroy *any* previous season's swede or turnip seed on his property.

(4) To refuse (when disease-free seed is procurable) to buy from any merchant seed which has not been certified as being disease-free by the Department of Agriculture.

THE OFFICIAL HERD-TEST.

AN ADJUNCT OF THE C.O.R. SYSTEM.

W. M. SINGLETON, Director of the Dairy Division.

THE Dairy Division is arranging to bring into operation during the coming season a scheme which, though based on methods which have long been in existence in New Zealand, is new in its intended mode of application to the testing of registered purebred dairy cows.

In order that we might know the feeling of breeders on the subject a general outline of the scheme has been circularized among all persons who at present have cows on C.O.R. Test, at the same time criticism being invited. We have been gratified at the prompt and sympathetic response. An overwhelming majority of the replies were enthusiastically in favour of the proposal. The scheme is to be an auxiliary of the Certificate-of-Record testing, and is to go hand-in-hand with it. At the same time the two "tests" are to be kept entirely independent, both in their carrying-out and in their publication or advertisement, and it is desired to assure all persons interested that the C.O.R. test as it stands at present will continue unaltered and uninterfered with. In order to avoid any possibility of confusion it is proposed to designate the new system—the Official Herd-Test, or, abbreviated, the O.H.T. This title, in its absolute distinctness from Certificate of Record, or C.O.R., and the several misnomers in more or less popular usage, such as S.O.R. (semi-official record) and S.O.T. (semi-official test), should avoid a merging of the two in the mind of any one considering yield-performances under both methods

MAIN FEATURES OF THE SCHEME.

The Official Herd-Test will be open to all breeders entering cows for Certificate-of-Record Test. The rules governing the O.H.T. have, however, not yet been drawn up in detail. The season will be commenced with a brief set of rules covering only the principal items, in expectation that the first year's work will provide experience and more complete knowledge of what is required. In the meantime the following particulars will provide information concerning the more salient features of the system.

(1) The Dairy Division of the Department of Agriculture will accept for Official Herd-Test cows that are registered in the New Zealand herd-book of the breed to which they belong. Several C.O.R. breeders have recommended that the scheme be extended to include grade and even crossbred cows. Our present feeling, however, is that generally this branch of testing is sufficiently well catered for by the association herd-testing and its variants. Nevertheless, where the C.O.R. testing breeder so desires, the Dairy Division will be prepared to extend the Official Herd-Test to include cows other than purebreds in his herd.

(2) No person will be eligible to enter cows for the Official Herd-Test unless he already has at least one cow accepted for Certificate-of-Record Test, and for which he has paid the necessary fee:

Provided that in the event of a person entering cows for this test, and only one cow for C.O.R. Test, he will not be entitled to a refund of C.O.R. fees on withdrawal of the C.O.R. test cow if he desires the Official Herd-Test continued.

(3) The last cow entered for Official Herd-Test must calve not more than ninety days after the date of calving of the last cow entered for C.O.R. Test.

(4) No animal will be eligible for acceptance unless she shall have calved not more than forty-five days prior to the Testing Officer's visit for the purpose of taking samples for C.O.R. Test.

(5) The owner must forward to the Director of the Dairy Division, at least a fortnight before due calving-date, and on a form to be supplied by the Department, an application properly filled in with the particulars required by such form. [NOTE.—The object of requesting a fortnight's notice is to enable us to make arrangements for our Testing Officer to provide the necessary sample-bottles and general outfit required. It is quite recognized, however, that in many instances a fortnight's notice will not be possible for the approaching season, and consequently the rule will not be strictly enforced for this, the first, season.]

(6) Fees will be payable to the Director of the Dairy Division within fourteen days after the taking of the second samples by the Testing Officer.

(7) Milking-machines may be used.

(8) The owner will be expected to arrange his milking-hours to suit the convenience of the Testing Officer.

(9) The owner will be asked to provide whatever means of indentification the Director of the Dairy Division may consider necessary. This will probably be by photographs or tattooing in the case of broken-coloured animals, and tattooing for animals of solid colour.

(10) Should any cow on Official Herd-Test be sold during the testing-period to a person who has a cow on C.O.R. Test, the Division will endeavour to complete the test. In no other case, however, does the Division guarantee to complete the testing of cows sold before the expiry of their testing-period.

(11) The testing-period will be for a maximum of 305 days, commencing with the day of calving.

(12) The Testing Officer is to have the right at any time to visit the farm on which a cow is under test. He will make his testing visits, as nearly as possible, once every calendar month. For the first milking during his visit he will record the time at which the milking was made, and as opportunity offers he will strip the cows sufficiently to ensure that they have been milked dry. For the remaining milkings of the twenty-four-hour visit he will take check weights and samples, and the last milking is to be twenty-four hours later than the first milking of his visit. All samples are to be kept under lock and key or sealed until tested. No cow will be tested when the yield is less than 4 lb. milk per day. No cow will be tested until a period of at least ninety-six hours has elapsed between calving and the taking of the first sample.

(13) The percentage of butterfat for the month will be that found from the one day's samples taken by the Testing Officer.

Should the average percentage of fat found in the milk during any monthly test be considered abnormal by the Director of the Dairy Division, he may reject that test and use the average percentage of fat obtained from the preceding and succeeding months as a basis for computation of the fat-production for that month. The milk-production for the month will be calculated by totalling the one day's milk-weights taken by the Testing Officer and multiplying the result by the number of days in the month. The monthly fat-production of a cow will be calculated by figuring the total milk credit for the month at the test for the day obtained by the Testing Officer. The season's production will be calculated by totalling the production of pounds of milk and butterfat for each month or part thereof during one lactation period, and not exceeding 305 days, commencing with the day of calving. For the period between calving and the commencement of the calendar month during which the first samples are taken, the yield will be calculated at the rate of the milk weights and test found by the Testing Officer at the time of his first monthly visit after calving. For the period between the three hundred and fifth day, or the drying-off date, and taking of the last samples preceding such date the production will be calculated at the rate of the last milk weights and test found by the Testing Officer. The period between drying-off date and the taking of the last samples is not to exceed forty-five days.

(14) The dates of the Testing Officer's monthly visits to a breeder's farm will be governed by the requirements of C.O.R. testing, and not by cows on Official Herd-Test.

(15) The Director of the Dairy Division may decline acceptance of application in any case where such testing cannot conveniently be undertaken by the existing staff of Testing Officers.

(16) The fee for Official Herd-Testing will be 2s. 6d. per monthly test per cow for each of the first two tests, and in the event of continuance of the test no further fee will be charged for the remainder of the lactation season not exceeding 305 days.

(17) Cows on Official Herd-Test are to be milked either before or after the C.O.R. cows.

(18) The owner will be supplied each month with a statement of the yield of each cow for the preceding month and from date of calving to the end of that month. He will also be supplied at the end of the season with a statement indicating the yield of each cow for that period.

(19) A breeder owning a cow with an Official Herd-Test record must, whenever advertising or publishing the record, use the description "Official Herd-Test," or the abbreviation O.H.T. It will not be permissible to use any description which is likely to be confused with the Certificate-of-Record testing, such as S.O.R. (semi-official record), S.O.T. (semi-official test), &c.

There will, of course, be no minimum butterfat requirement, and no restriction of period between calvings, as in the C.O.R. system. The O.H.T. is merely to provide information relative to yield.

Although provision has been made for a 305-day maximum season there is nothing to prevent the withdrawal of a cow at any prior date the owner may desire.

OBJECTS IN VIEW.

In introducing the Official Herd-Test we have in view several objects of importance to dairy-farmers. The more outstanding of these may be briefly summarized thus : The C.O.R. test entails fairly heavy expense on the breeder, not only on account of the high testing fee, but because of the extra feeding. Purebred herds, just as any other herds, though perhaps to a lesser degree, include cows which should be culled. At low cost a breeder, by means of the Official Herd-Test, will be able to ascertain what cows are worth the care and expense of a C.O.R. test. The Official Herd-Test requires no taking of milk-weights and no preparing of returns of any kind by the owner. The system has been proved adequately accurate for the purpose.

The Official Herd-Test is expected to assist in still wider education of dairy-farmers in the value of butterfat records. Wider education must ultimately mean greater efficiency. Last, and most important, if the Official Herd-Test meets with strong and continued support it must sooner or later assist in increasing the country's average butterfat-production per cow, which is only another way of saying that it must improve the economic position of the dairy-farmer and the dairy industry.

In conclusion, it should be clearly understood that the Official Herd-Test is designed as a means of assisting breeders of dairy cattle in improving the productive capacity of their herds. Any criticism breeders may wish to make will be welcomed.

EXCESS COST OF CREAM TRANSPORT.

DEALING with the question of uneconomic collection of cream in certain districts, induced by competition among dairy companies, at the recent annual conference of the National Dairy Association, Mr. W. M. Singleton, Director of the Dairy Division, remarked as follows :—

"In a number of districts it is very important that something should be done, by way of co-operation, towards reducing the costs of cream delivery. In some districts the block system could be brought in, but it may be impracticable for dairy companies in a number of other districts to consider each company confining its operations to an area to be agreed upon. In such instances the question might be considered as to whether one lorry might not take all the cream on its route and deliver it to the respective factories to which it belongs. Where the factories are situated close together this would appear to be practicable.

"We have had a rough survey made of the general position, and it is estimated that excess cost of transport of cream must amount approximately to £35,000. It would appear almost incredible that any dairy company would undertake the cartage of some suppliers' cream under the circumstances reported to me. Lorries from various companies traverse the same road in some districts, and pass from one to three or more dairy factories. Contrast this with the position in another district from which three different companies get supplies of cream by rail. One contractor here carries all the cream to the station, thus facilitating more frequent delivery. My information is to the effect that the position is satisfactory to each of the companies concerned.

"It is high time that more co-operation was evidenced in this matter of cream-cartage. Suppliers should get in touch with the directors of their company if they have reason to believe that it is one which is losing money in this manner. Such pressure would probably induce companies to find ways and means of solving the problem. Suppliers should realize that these excess costs are paid out of proceeds from butter-sales, and that if they did not occur the dairy farmer could reasonably expect a higher payment for butterfat."

THE COMPOSITION OF BRAN AND POLLARD.

MEANS FOR DISTINGUISHING QUALITY.

L. D. FOSTER, M.Sc., A.I.C., Chemistry Section, Wellington.

IN the *Journal of the Board of Agriculture* (England) for March, 1917, Wood and Adie described briefly the practices current in England up to that date in the separation of the different parts of the wheat berry in milling. They state that usually flour includes all the particles into which the wheat has been ground which are fine enough to pass through "silks" or sieves with 130 meshes to the linear inch. Those portions of the ground wheat which will not pass through this sieve form the offals; the coarser offals are separated as bran, which does not pass through a wire sieve (No. 16) with sixteen meshes to the linear inch. They give the average results of analyses of a series of samples as follows:—

Table 1.

	Moisture.	Protein.	Fibre.	Ash.	Oil.	Carbohydrates.
	%	%	%	%	%	%
Bran	13·63	13·45	10·58	5·40	3·92	53·12
Straight-run offal (= pollard in New Zealand)	13·17	15·52	4·95	3·45	4·41	58·50

The same writers consider that wheat offals are characterized not only by a limited range in the size of their particles, but by a definite chemical composition. In some countries the offals, apart from the bran and pollard, are further subdivided into middlings, fine middlings, sharps, &c. In New Zealand offals are divided only into bran and pollard.

Amos ("Processes of Flour Manufacture," 1920) says that Nos. 11, 12, and 13 silks are usually employed for the dressing of flour.

In the experimental milling operations carried out by the Chemistry Section of the New Zealand Department of Agriculture the wheats are milled on an Allis-Chalmers reduction machine. The bran fractions are obtained on wire sieve No. 16 (sixteen meshes per linear inch), and the pollard fractions on silk No. 12 (120 meshes per linear inch). Methods adopted in the actual milling are varied slightly to give the best results with each individual wheat-sample, but it may be said that for all practical purposes the methods are standardized. It is interesting to note that though the experimental methods were worked out quite independently in order to give the best results on this particular experimental mill, they are almost exactly similar to the commercial methods quoted by Wood and Adie, and Amos, and, indeed, to commercial methods in general. The offals obtained from the local wheat-samples should therefore be similar to and representative of genuine local brans and pollards; and while it is not suggested that the examination of the products of an experimental mill does away with the necessity for further work on commercial samples, the results obtained should be a useful basis for any further work which may be performed in the future. To this end analyses were made of a number

of genuine brans and pollards separated on the Department's experimental mill, and obtained from wheats grown in the Dominion. The following table gives the results of milling of the different samples: –

Table 2.—Milling Results.

Sample No.	Variety.	Locality where grown.	Bran.	Pollard.	Flour.
			%	%	%
S 709 ..	Tuscan ..	Arrowtown ..	15·1	12·2	72·7
S 775 ..	Yeoman ..	Ashburton ..	10·8	15·0	74·2
S 771 ..	Velvet ..	,, ..	11·5	14·2	74·3
S 769 ..	Marquis ..	,, ..	14·0	16·0	70·0
T 75 ..	College Hunter's	,, ..	14·8	11·8	73·4
S 773 ..	Velvet Ngapara ..	,, ..	10·9	12·9	76·2
S 777 ..	Red Fife ..	,, ..	14·6	13·4	72·0
S 712 ..	Tuscan ..	Gibbston ..	12·2	14·1	73·7
T 101 ..	Hybrid W. ..	Horrelville ..	11·0	11·7	77·3
T 52 ..	Solid-straw Tuscan	Gore ..	16·2	14·5	69·3
T 77 ..	,,	Ashburton ..	12·0	16·3	71·7
S 713 ..	Hunter's ..	Tarras ..	15·7	12·0	72·3
Average	..	..	13·2	13·7	73·1

The samples consisted of a number of well-known varieties, and were obtained from widely separated localities.

In the next table are given the results of the analyses of brans, together with the yield of flour and the amount of protein in the flour.

Table 3.—Analyses of Brans.

Sample No.	Flour.		Bran.					
	Yield.	Protein.	Moisture.	Protein.	Fibre.	Ash.	Oil.	Carbohydrates.
	%	%	%	%	%	%	%	%
S 709 ..	72·7	11·81	12·44	16·25	10·60	5·53	3·00	55·18
S 775 ..	74·2	14·19	11·08	15·69	10·98	6·12	3·28	52·85
S 771 ..	74·3	13·56	12·47	15·06	10·95	5·48	3·38	52·66
S 769 ..	70·0	13·75	12·09	14·88	10·22	5·04	4·30	53·47
T 75 ..	73·4	10·31	12·40	14·50	9·67	4·20	3·45	55·78
S 773 ..	76·2	11·88	11·78	14·25	11·63	5·19	4·65	53·82
S 777 ..	72·0	10·56	11·40	13·56	10·38	5·03	4·07	55·56
S 712 ..	73·7	9·38	11·93	12·75	11·35	5·86	3·67	54·44
T 101 ..	77·3	9·63	12·76	12·00	10·18	5·40	3·17	56·49
T 52 ..	69·3	9·44	12·10	11·75	10·38	4·27	4·20	57·30
T 77 ..	71·7	9·69	12·65	11·56	11·00	3·37	3·35	58·07
S 713 ..	72·3	7·69	12·46	10·41	10·83	4·56	3·90	58·14
Average of N.Z. samples	73·1	10·99	12·11	13·55	10·68	5·00	3·70	58·31
Average of English samples (Wood and Adie)	..	..	13·63	13·45	10·58	5·40	3·92	53·12

The table is arranged in order of protein content of the brans. The averages for the local samples are practically the same as those obtained by Wood and Adie from their series of English samples, the results of which are given at the bottom of the table.

The results of analyses of the pollards are as follows:—

Table 4.—Analyses of Pollards.

Sample No.	Moisture.	Protein.	Fibre.	Ash.	Oil.	Carbo-hydrates.
	%	%	%	%	%	%
S 709	12·48	17·25	4·70	3·49	3·87	62·08
S 775	11·77	18·13	5·48	4·12	4·08	56·42
S 771	12·17	16·25	4·40	3·36	4·33	59·49
S 769	11·89	15·75	3·42	2·83	3·90	62·21
T 75	12·57	15·13	3·97	2·57	4·27	61·49
S 773	11·69	16·44	5·52	3·95	4·65	57·75
S 777	11·49	15·94	3·58	2·95	4·00	62·04
S 712	11·87	15·13	5·92	4·14	4·87	58·07
T 101	12·68	13·63	4·60	3·50	3·89	61·70
T 52	12·28	12·69	5·00	3·19	4·50	62·34
T 77	12·60	13·93	5·43	2·65	4·07	61·32
S 713	12·49	12·19	3·83	2·70	4·38	64·41
Average	12·16	15·21	4·65	3·29	4·23	60·78
Average of English samples (Wood and Adie)	13·75	15·66	4·52	3·30	4·67	58·13
Average of N.Z. commercial samples, 1924	11·35	15·12	5·30	3·46	..	..

The samples in this table are arranged in the same order as those in Table 3. Here again the averages from the analyses of pollards obtained on the experimental mill show a close resemblance in composition to those of the commercial samples analysed by Adie and Wood in England; this is especially so in the figures for fibre and ash. The two sets of average figures in the tables show that the pollards thus differ considerably from the brans in protein, ash, and especially fibre, such figures affording a fairly definite means of differentiation between fair average quality pollards and those containing an excessive amount of bran.

In Table 4 are also appended the averages of thirteen genuine local commercial pollards analysed by the writer in 1924. Here the composition of the local samples resembles even more closely that of the pollards obtained on the experimental mill. It seems fair to assume, then, that offals obtained on the experimental mill differ very little, if at all, from genuine commercial samples, and that data from such samples are applicable to pollards obtained on a commercial scale. This is of considerable importance in the control of the quality of brans and pollards, for it is an easy matter in the mill deliberately to grind part of what should remain in the bran portion sufficiently finely for it to pass into the pollard. Since branny (adulterated) pollards are unsuitable for certain types of stock-feeding, especially the feeding of swine and young calves, it is essential that there should be some form of standardization in such an important feeding-stuff. Since the quality and composition of wheat vary somewhat each year, and from what has been said above, it would appear that information obtained from analyses of experimentally milled offals should be a useful guide each year to the quality and genuineness of similar commercial products.

The following table gives the limits in composition of the genuine brans and pollards obtained on the experimental mill :—

Table 5.—Limits in Composition.

—	Protein.	Fibre.	Ash.	Oil.	Carbohydrates.
	%	%	%	%	%
Brans ..	16·25—10·41	11·63—9·67	6·12—4·20	4·65—3·00	58·07—52·66
Pollards ..	18·13—12·19	5·92—3·42	4·14—2·57	4·87—3·87	64·41—56·42

There is thus a fairly well defined difference in the chemical composition of the two products. The differences between the fibre and ash figures are at once apparent, though it should be mentioned here that in the case of one bran (T 77) its ash content was found to be 3·37 per cent. This is such an abnormal figure that it is excluded from the table. Moreover, if such a bran were milled so that part of it passed into the pollard, attention would not be drawn to the presence of bran because its ash content would be so nearly that of genuine pollard.

It must be pointed out, too, that the above results were obtained from individual samples representing distinct and rather widely differing varieties. The miller generally blends several varieties of wheat, and is for that reason more likely to produce offals with compositions closer to the averages, but rarely approaching the outside limits given in Table 5. From an examination of the figures obtained for protein and ash in local samples of offals it should be possible to say whether they have been separated by the methods of usually accepted milling practice—that is, whether the pollards contain an average or an excessive amount of branny particles.

SUMMARY.

(1) Twelve samples of bran and twelve of pollard, obtained from pure local varieties of wheat, and separated on an experimental mill, were analysed.

(2) The results agreed closely with those obtained from a series of English commercial samples of brans and pollards examined by Wood and Adie.

(3) The pollards also resembled closely in composition a series of good average quality commercial pollards milled locally and examined in 1924.

(4) The averages of results showed a distinct difference between bran and pollard in protein, fibre, ash, and carbohydrates. From an examination of the protein, fibre, and ash figures one should gain a fairly good idea of the quality of the products. The differences, it is thought, are distinct enough to afford a means of distinguishing between fair average quality and adulterated pollards.

Stock Improvement.—Records continue to show that ownership of purebred males leads promptly to a large number of purebred female animals in all classes of stock kept and to a gradual grading-up process, with the reduction of scrub stock to a negligible number.—United States *Agriculture Year-book, 1925.*

LAMB-FATTENING ON FORAGE CROPS.

TRIALS IN MARLBOROUGH, SEASON 1926–27.

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THE lamb-fattening trials at Seddon, which were initiated in 1925–26, were continued in the past season. A full account of the first season's operations was published in the *Journal* for July, 1926. It will be remembered that when production costs were balanced against the net returns from the fat lambs the results on a per-acre basis worked out as follows: Peas, £2 6s. 6d. loss; rape, £4 10s. 3d. profit; chou moellier, £1 18s. 9d. profit; lucerne, £2 3s. 9d. profit.

It may be recalled that the peas at first drafting gave 80 per cent. of fat lambs, but that no second feeding was available. It was also shown in the previous article that even if ordinary field-peas at as low a cost as 6s. per bushel had been used the results would not have been payable, especially in view of the fact that general experience shows that field-peas are not only less palatable but also less efficacious than wrinkle-peas for fattening purposes. In view of these considerations it was decided to discontinue the tests with peas during the past season.

As previously, a total area of 10 acres, fenced into five 2-acre blocks, was used. Water was laid on to each plot, and every precaution taken to secure even and comparable conditions in regard to soil, manuring, and feeding conditions.

The lambs used were again crossbreds—English Leicester ram on half-bred ewes.

Weather conditions in the 1926–27 season differed very materially from those in 1925–26, as the following rainfall records kept at Seddon will show:—

1925–26 Season.			1926–27 Season.		
Month.	Rainfall (Inches).	Number of Wet Days.	Month.	Rainfall (Inches).	Number of Wet Days.
September ..	2·31	12	September ..	1·79	12
October ..	1·73	10	October ..	3·28	16
November ..	0·72	5	November ..	2·43	15
December ..	0·25	3	December ..	6·13	10
January ..	1·31	9	January ..	0·17	2
February ..	2·66	8	February ..	1·64	6
March ..	2·73	5	March ..	1·40	6
April ..	0·37	6	April ..	1·11	5
Totals ..	12·08	58	Totals ..	17·95	72

It will readily be seen that the growing season in 1926–27 was much more favourable than that of 1925 26. In the former season extremely dry weather set in in January, and, coming as it did in sharp contrast to the wet weather of the spring, it caused the rank growth of fodder, especially in the case of rape, thousand-headed kale, and chou moellier, to wilt somewhat before the lambs could be turned on. The lucerne, which had grown very rank after the first hay-cut, had to be mown before the lambs could be turned on. The crops

tested this season were 2-acre plots of (1) lucerne, (2) Japanese millet, (3) rape, (4) thousand-headed kale, (5) chou moellier.

All crops were manured with 44–46 per cent. superphosphate at the rate of 2 cwt. per acre, the lucerne, an established stand, being, of course, simply top-dressed. In preparation for sowing the land received the following cultivation: In the autumn (1926) the ground was given two strokes with the cultivator to kill weeds. Ploughing was carried out in August. The ground broke up very finely, so that little further cultivation was necessary Three strokes of the harrows followed ploughing, then another stroke just before drilling. After drilling, the ground was rolled. The millet plot also received two more strokes of the harrows after sowing, while the lucerne stand was given three strokes with a Hustler cultivator in August.

On 18th January, 1927, 20 lambs were put on the lucerne plot, and 45 per plot on the Japanese millet, rape, thousand-headed kale, and chou moellier. The lambs at time of going on to the plots were evenly assorted, and were worth approximately 18s. per head.

On 11th February, 1927, the first draft of fats was taken off, an even standard of selection being adopted. The results were as follows:—

Lucerne	16	fat out of	20	= 80	per cent.
Japanese millet	27	,,	45	= 60	,,
Rape	33	,,	45	= 73	,,
Thousand-headed kale ..	26	,,	45	= 58	,,
Chou moellier (1 missing) ..	44	,,	44	= 66	,, (on 45)

After the first drafting, 37 lambs were put back on the lucerne and 30 on the rape. When these two plots were eaten off it was found to be impossible to obtain space at the freezing-works, so that all the lambs had to be moved on to other feed for a time. As near as can be judged from the condition of the lambs when they were taken off the plots there was an even number of fats (18) from each plot, or a total of 36. This makes approximately 50 per cent. fat in the second draft from the lucerne, and 60 per cent. from the rape. The second drafts were taken off on 23rd February, 1927. This draft may be put down as worth 18s. per head when turned on to the rape and the lucerne respectively.

On 14th March it was again found possible to turn lambs on to all the plots, the apportionment being somewhat as follows: Lucerne, 30; Japanese millet, 30; rape, 30; chou moellier, 25; thousand-headed kale, 25. None of the feed lasted long enough to make the lambs prime. An assessment for grazing for twelve days—that is, to 26th March (exclusive)—has therefore been made. The value of the fodder works out at approximately 1s. per head per week.

The experiment of chaffing lucerne hay from the spring cut was tried this season. Owing to the wet spring, however, the quality of the hay was somewhat inferior. Throughout the two seasons in which trials have been in operation the lambs have shown little tendency to consume either lucerne hay or chaff. In both seasons the conditions at the times of feeding off have been extremely dry.

FREEZING-WORKS REPORTS.

The freezing-works reports on the first and second drafts may be summarized as follows:—

FIRST DRAFT TAKEN ON 11TH FEBRUARY.

(1) Lucerne : 16 Lambs.

Grade.	Number.	Net Weight. lb.
To 36 lb	11	369
36 lb. to 42 lb.	3	114
Second quality	2	68
Total	16	551

Average weight, 34·44 lb. Price realized, £1 2s. 8d. per head ; total, £18 2s. 8d.

(2) Japanese Millet : 27 Lambs.

Grade.	Number.	Net Weight. lb.
To 36 lb.	19	629
36 lb. to 42 lb.	6	234
Second quality	2	68
Total	27	931

Average weight, 34·5 lb. Price realized, £1 2s. 9d. per head ; total, £30 14s. 3d.

(3) Rape : 33 Lambs.

Grade.	Number.	Net Weight. lb.
To 36 lb.	18	608
36 lb. to 42 lb.	7	266
42 lb. to 50 lb.	1	43
Second quality	6	205
Rejects	1	35
Total	33	1,157

Average weight, 35·06 lb. Price realized per head (inclusive of 1 reject), £1 2s. 5d. ; total, £36 19s. 9d.

(4) Thousand-headed Kale : 26 Lambs.

Grade.	Number.	Net Weight. lb.
To 36 lb.	15	500
36 lb. to 42 lb.	7	271
Second quality	4	127
Total	26	898

Average weight, 34·54 lb. Price realized, £1 2s. 5d. per head ; total, £29 2s. 10d.

(5) Chou Moellier : 30 Lambs.

Grade.	Number.	Net Weight. lb.
To 36 lb.	21	697
36 lb. to 42 lb.	7	266
Second quality	2	66
Total	30	1,029

Average weight, 34·3 lb. Price realized, £1 2s. 7d. per head ; total, £33 17s. 6d.

SECOND DRAFT, TAKEN ON 23RD FEBRUARY.

Joint Report on Fats.

Grade.	Number.	Net Weight. lb.
To 36 lb.	7	229
36 lb. to 42 lb.	5	187
Second quality	22	711
Rejects	2	48
Total treated	36	1,175

Average weight, 32·6 lb. Average price per head (inclusive of rejects at lower price), 19s. 11d. delivered at the works. Total price realized, £35 17s., divided equally between 18 lambs off rape and 18 lambs off lucerne—£17 18s. 6d. each.

No third draft of fats was taken, but, as already mentioned, it was possible on 14th March to turn 140 lambs on to the plots, the apportionment being—lucerne, 30; Japanese millet, 30; rape, 30; thousand-headed kale, 25; chou moellier, 25. None of the feed lasted long enough to fatten. The fairest estimate that can be made is to allow 1s. per head per week for grazing. Taking into consideration the time taken to fatten the lambs—twenty-six days—out of which time they were twelve days on the plots and fourteen days subsequently feeding elsewhere, this price works out approximately correctly. The lambs were worth about 16s. when they went on to the plots, and in four weeks, according to the price received, were worth on an average about £1 per head. Fodder-values were reckoned as follows: (1) Lucerne for twelve days for 30 lambs at 1s. per head per week, £2 11s. 6d.; (2) Japanese millet for twelve days for 30 lambs, £2 11s. 6d; (3) rape for twelve days for 30 lambs, £2 11s. 6d.; (4) thousand-headed kale for twelve days for 25 lambs, £2 2s. 10d.; (5) chou moellier for twelve days for 25 lambs, £2 2s. 10d.

RETURNS FROM VARIOUS CROPS.

Lucerne.

Gross returns: First draft, £18 2s. 8d.; second draft, £17 18s. 6d.; third feeding, £2 11s. 6d.; 1½ tons lucerne hay left uneaten, at £3 per ton, £4 10s.: total, £43 2s. 8d.

Expenses: Cost of production—labour, seed, manure, cultivation, haymaking, and top-dressing, £1 16s. per acre; annual rental value, about £1 7s. 6d. per acre. It must be reckoned, however, that the first cut or feeding of lucerne in September would at least pay the rent. Then, again, no allowance has been made for those lambs in the first draft which were grazed without being fattened. Taking these facts into consideration, full production cost is allowed at £1 16s. per acre, or £3 12s. for 2 acres. Sixteen lambs fattened in first draft were worth 18s. per head when put on to the plot, a total of £14 8s.; 18 lambs in second draft were worth 18s. per head, total £16 4s.

Adding these items we have a total debit of £34 4s., and this amount deducted from the gross returns of £43 2s. 8d. leaves a net profit of £8 18s. 8d. for 2 acres, or £4 9s. 4d. per acre.

Japanese Millet.

Gross returns: First draft, £30 14s. 3d.; second draft, nil; grazing for third lot of lambs, £2 11s. 6d.: total, £33 5s. 9d.

Expenses: Cost of production—cultivation, seed, manure, &c., £5. Rent of land: It may be safely assumed that grazing for the lambs which did not actually finish on the millet paid for the rent. Value of first draft (27), 18s. per head when they went on to plots, or £24 6s.

Total debits thus amount to £29 6s., which deducted from the gross returns of £33 5s. 9d leaves a net profit of £3 19s. 9d. on 2 acres, or £1 19s. 10d. per acre.

Rape.

Gross returns: First draft, £36 19s. 9d.; second draft, £17 18s. 6d.; grazing for third lot of lambs, £2 11s. 6d.: total, £57 9s. 9d.

Expenses: Rent defrayed by balance of lambs grazed but not finished on rape in first draft. Production cost—cultivation, seed, manure, &c., £4 16s. 6d. Value of first draft (33) at 18s. per head when put on to plots, £29 14s.; second draft (18) at 18s., £16 4s.

The total debits of £50 14s. 6d. being deducted from the gross receipts of £57 9s. 9d., a net profit of £6 15s. 3d. is shown on 2 acres, or £3 7s. 7d. per acre.

Thousand-headed Kale.

Gross returns: First draft, £29 2s. 10d.; grazing from third lot, 1s. per head, £2 2s. 10d.: total, £31 5s. 8d.

Expenses: Rent paid for by lambs grazed but not finished in first draft. Production cost—cultivation, seed, manure, &c., £5 8s.; value of first draft of lambs at 18s. per head, £23 8s.: total, £28 16s.

Deducting this amount from gross returns, a profit is shown of £2 9s. 8d., or £1 4s. 10d. per acre.

Chou Moellier.

Gross returns: First draft, £33 17s. 6d.; grazing from third lot at 1s. per head, £2 2s. 10d.: total, £36 0s. 4d.

Expenses: Rent defrayed by lambs grazed but not finished in first draft. Production cost—cultivation, seed, manure, &c., £5 14s; value of first draft at 18s. per head, £27: total, £32 14s.

Net profit, £3 6s. 4d. from 2 acres, or £1 13s. 2d. per acre.

Summary.

The profit per acre for each of the five crops may be summarized as follows: Lucerne, £4 9s. 4d.; Japanese millet, £1 19s. 10d.; rape, £3 7s. 7d.; thousand-headed kale, £1 4s. 10d.; chou moellier, £1 13s. 2d.

Last season every crop showed a profit with the exception of peas. This season every crop tried has shown a profit. As was the case last season, the highest margins of profit are from lucerne and from rape. This season lucerne is easily first, the margin of profit being more than double that of last season. The margin of profit from rape is lower this season than it was last season. Japanese millet has shown a net profit of just under £2 per acre, against a failure last season. Chou moellier has shown within a few shillings of the margin of profit recorded last season. Thousand-headed kale, tried for the first time on the plots at Seddon, in spite of the fact that it had the advantage of being grown after peas, although quite profitable, yet shows a smaller margin than any of the other crops.

The thanks of the Department of Agriculture and of the Awatere branch of the Farmers' Union are due to Mr. C. P. Gainsford for his co-operation in carrying out the work on the plots (again located on his farm), and to Mr. N. West, stock agent of the N.Z. Farmers' Co-operative Association, for drafting of lambs; also to the New Zealand Refrigerating Company, which donated the manure for use on the plots.

STINKING-SMUT OF WHEAT.

V. SUMMARY OF THREE YEARS' EXPERIMENTS ON CONTROL, AND DETAILED RESULTS FOR 1926–27 SEASON.

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Three Years' Summary.

THE combined results of the past three years' field experiments with the best known seed treatments for the control of stinking-smut in wheat are here presented (Table 1). Each year the treatments have been carried out on the main wheats of New Zealand—Solid-straw Tuscan, Hunter's, and Pearl or Velvet Chaff—the samples of which were obtained from ordinary machine threshed and dressed commercial lines. Over 100,000 individual wheat-seeds were sown by hand during the experiments, and the resultant plants pulled and the heads counted. The experiments were carried out in the open on normal Canterbury wheat-growing land, at the Ashburton Experimental Farm. The figures given in the table represent the number of grain-bearing heads produced by an equal number of wheat-seeds from the same bulk sample, treated and untreated, growing in adjacent rows under apparently identical conditions. The number of heads produced is not necessarily an accurate measure of comparative yields, but it is the nearest approximation that the experimental conditions would allow. The figures for each year, which include all the wheats used, are given separately in the table so as to show how far the conclusions to be drawn from the combined results may be relied upon to represent the facts in any one of the years.

Table 1.—Combined Results of Three Years' Experiments on the Control of Stinking-smut.

Treatments.	Total Heads produced.		Decrease or Increase due to Treatment.	Total Smutted Heads.	
	Treated.	Untreated.		Treated.	Untreated.
Copper carbonate dust—					
1925	19,505	19,466		25	1,964
1926	7,242	7,350		5	1,104
1927	13,714	15,412		0	1,290
Total for 3 years ..	40,461	42,228	Decrease 4·1%	30	4,358
Semesan dust, 1 oz. per bushel—					
1925	6,179	5,739		0	622
1926	3,435	3,338		2	343
1927	3,206	3,403		11	390
Total for 3 years ..	12,820	12,480	Increase 2·7%	13	1,355
Semesan steep, 1 hour at 0·2%—					
1925	5,966	5,919		0	840
1926	3,441	3,445		11	372
1927	3,157	3,272		0	384
Total for 3 years ..	12,564	12,636	Decrease 0·6%	11	1,596

Table 1—continued.

Treatments.	Total Heads produced.		Decrease or Increase due to Treatment.	Total Smutted Heads.	
	Treated.	Untreated.		Treated.	Untreated.
Uspulun, 1 hour at 0·25%—					
1925	6,136	5,871		0	735
1926	3,565	3,558		6	536
1927	3,220	3,300		0	362
Total for 3 years ..	12,921	12,729	Decrease 1·5%	6	1,633
Germisan, ½ hour at 0·25%—					
1925	6,135	5,750		0	810
1926	3,534	3,545		4	465
Total for 2 years ..	9,669	9,295	Increase 3·9%	4	1,275
Clarke's Wheat Protector—					
1925	5,091	5,911		4	754
1926	3,123	3,705		0	486
1927	2,560	3,469		0	311
Total for 3 years ..	10,774	13,085	Decrease 17·6%	4	1,551
Bluestone, 1%—					
1925	5,875	6,425		21	671
1926	2,864	3,839		0	473
1927	2,273	3,531		0	324
Total for 3 years ..	11,012	13,795	Decrease 20·1%	21	1,468
Bluestone, 2%—					
1925	5,051	6,289		6	786
1926	2,585	3,834		0	484
Total for 2 years ..	7,636	10,123	Decrease 24·5%	6	1,270
Formalin, 1–320—					
1925	3,432	6,332		2	714
1926	3,192	3,642		0	427
1927	2,967	3,269		0	434
Total for 3 years ..	9,591	13,243	Decrease 27·5%	2	1,575
Formalin, 1–480—					
1925	4,274	6,180		8	814
1926	3,126	3,534		0	402
1927	3,154	3,241		0	489
Total for 3 years ..	10,554	12,955	Decrease 18·5%	8	1,705

The general conclusions may be briefly summarized as follows :—

(1) The copper carbonate dust treatment satisfactorily controlled stinking-smut, but produced 4 per cent. fewer heads than the same weight of untreated seed.

(2) Clarke's Wheat Protector, bluestone 1 per cent., and formalin 1–480 all controlled the smut very well, but caused a decrease in production of 17 per cent., 20 per cent., and 18 per cent. respectively. It

should be noted that most of this decrease with formalin occurred in 1925, in which year the seed was allowed to dry out thoroughly after treatment and before sowing.

(3) Bluestone 2 per cent. and formalin 1–320 caused a decrease of 24 per cent. and 27 per cent. respectively

(4) The mercuro-phenol preparations, Semesan, Uspulun, and Germisan, gave good but not complete control of the smut, with, on the whole, a slight improvement in production.

(5) All the treatments eliminated stinking-smut in one or two of the seasons, but none was completely successful in all three.

Experimental Results for 1926–27.

(For details of materials and methods see second article of this series in *Journal* for May, 1925.)

Copper Carbonate.—Five makes of copper carbonate were used in this season's experiments, one of them, Corona, containing approximately 18 per cent. copper, the others from 40 per cent. to 50 per cent. All were dusted on to the smutted seed at the rate of 2 oz. per bushel. No significant difference was shown by any of the brands; all completely eliminated the smuts, with, on the whole, a slight drop in germination and heads produced as compared with the adjacent untreated controls.

Colloidal Copper.—A new preparation by the Pittsburgh Plate Glass Co., Newark, N.Y., U.S.A. It gave very similar results to copper carbonate, except that disinfection was not quite so complete.

Semesan.—Used both as a dust at 1 oz. per bushel and as a 0·2-per-cent. solution in which the seed was steeped for one hour at room-temperature. As a dust it failed to completely eliminate the smut in either of the three wheat varieties, smut appearing, curiously enough, in the treated rows of Velvet Chaff, while the untreated rows remained quite clean. As a steep Semesan gave complete disinfection. No significant difference was shown by either of the Semesan treatments in germination or heads produced as compared with the untreated controls.

Uspulun.—Seed steeped for one hour in 0·25 per cent. solution at room-temperature. Gave complete control of the smut, with a slight improvement in germination over controls.

Clarke's Wheat Protector.—Gave complete control of the smut, but caused a considerable drop in germination.

Bluestone (Copper Sulphate).—Seed dipped for ten minutes in 1 per cent. solution at room-temperature, kept covered and moist overnight, and sown on the following day. This treatment completely controlled the smut, but lowered the number of plants by 44 per cent. and the number of heads by 35 per cent. as compared with controls.

Formalin.—Seed steeped at room-temperature for ten minutes in solutions made up at the rate of 1 part commercial formalin (39 per cent.) to 320 parts water (1 pint in 40 gallons), and 1 part formalin to 480 parts water (1 pint in 60 gallons). The steeped seed was covered and kept moist overnight, and sown on the following day. Both treatments completely controlled the smut. The 1–320 steep lowered germination and heads by about 10 per cent., and the 1–480 steep by 1 per cent. to 2 per cent.

Table 2.—Stinking-smut Experiments at Ashburton Experimental Farm, Season 1926-27.

Dates of sowing: Controls of Velvet Chaff, 19/5/26; all remainder, 28–31/5/26. First count, 8–10/8/26; final count, 3–6/2/27.

Treatment.	Velvet Chaff.											Solid-straw Tuscan.											College Hunter's.										
	Percentage Germination.				Plants.			Heads.				Percentage Germination.				Plants.			Heads.				Percentage Germination.				Plants.			Heads.			
	In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total	Smutted.	Percentage smutted.		In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total	Smutted.	Percentage smutted.		In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total	Smutted.	Percentage smutted.	
		First Count.		Mature Plants.									First Count.		Mature Plants.									First Count.		Mature Plants.							
		%	PE ±										%	PE ±										%	PE ±								
Control	93·5	85·5	1·30	82·0	164	0	0·0	516	0	0·0		96·5	..	..	..	..	..	..	..	..	..		98·5	83·0	1·32	82·5	165	19	11·5	451	46	10·2	
Copper carbonate (Corona) ..	93·0	86·2	0·91	80·2	321	0	0·0	820	0	0·0		94·5	88·2	0·76	80·0	320	0	0·0	876	0	0·0		95·5	87·0	1·40	75·7	303	0	0·0	823	0	0·0	
Control	..	87·0	1·30	85·5	171	1	0·6	500	3	0·6		..	..	..	..	..	..	..	..	..	..		..	90·5	0·97	85·0	170	15	8·8	423	37	8·7	
Copper carbonate (Stauffer's) ..	95·0	83·0	1·54	83·7	335	0	0·0	833	0	0·0		92·5	87·7	1·24	80·0	320	0	0·0	954	0	0·0		98·0	89·7	1·09	76·5	306	0	0·0	781	0	0·0	
Control	..	85·5	0·92	86·5	173	0	0·0	505	0	0·0		..	..	..	..	..	..	..	..	..	..		..	88·0	1·10	77·5	155	13	8·3	414	36	8·7	
Copper carbonate (Cuming Smith) ..	96·5	86·7	1·09	83·5	334	0	0·0	806	0	0·0		94·0	89·0	0·74	87·0	348	0	0·0	1,100	0	0·0		98·0	87·2	1·14	76·5	306	0	0·0	772	0	0·0	
Control	..	87·5	0·90	82·5	165	0	0·0	500	0	0·0		..	88·0	0·73	86·0	172	24	14·0	544	72	13·2		..	88·0	1·13	79·0	158	14	8·8	413	34	8·2	
Copper carbonate (Nichols) ..	95·0	86·5	1·68	83·2	333	0	0·0	941	0	0·0		95·5	89·0	1·10	81·7	327	0	0·0	990	0	0·0		97·0	85·2	1·26	79·7	319	0	0·0	968	0	0·0	
Control	..	86·0	1·83	80·0	160	0	0·0	557	0	0·0		..	85·5	1·08	80·0	160	19	11·9	537	78	14·5		..	85·0	1·17	81·5	163	27	16·5	539	94	17·4	
Copper carbonate (Mountain) ..	98·5	87·2	1·00	79·2	317	0	0·0	987	0	0·0		95·5	88·5	1·18	78·0	312	0	0·0	982	0	0·0		97·5	86·7	1·09	81·0	324	0	0·0	1,081	0	0·0	
Control	..	84·5	1·42	87·0	174	0	0·0	614	0	0·0		..	90·5	1·37	84·5	169	32	18·9	501	84	16·7		..	92·5	1·18	81·0	162	25	15·4	539	77	14·3	
Colloidal copper	95·5	88·2	0·83	79·5	318	0	0·0	1,011	0	0·0		95·5	86·2	1·20	81·5	326	0	0·0	1,024	0	0·0		96·5	87·2	0·87	83·5	334	1	0·3	1,050	3	0·3	
Control	..	87·5	1·24	84·0	168	0	0·0	613	0	0·0		..	84·0	1·33	83·0	166	19	11·4	582	61	10·4		..	87·5	1·16	85·0	170	44	25·8	574	148	25·7	
Semesan dust	95·5	87·0	1·07	84·7	339	2	0·6	985	4	0·4		97·5	92·2	0·81	87·2	349	2	0·5	1,172	6	0·5		98·0	89·5	1·08	81·5	326	1	0·3	1,049	1	0·1	
Control	..	89·0	0·91	84·5	169	0	0·0	529	0	0·0		..	83·5	1·29	81·0	162	18	11·1	538	69	12·8		..	86·5	1·06	82·0	164	29	17·7	567	112	19·7	
Semesan steep	99·0	91·0	0·90	88·0	352	0	0·0	963	0	0·0		95·5	89·7	1·22	86·2	345	0	0·0	1,156	0	0		97·5	92·0	0·82	86·2	345	0	0·0	1,038	0	0·0	
Control	..	88·0	1·15	86·5	173	0	0·0	551	0	0·0		..	88·0	1·30	83·5	107	38	22·7	578	135	23·2		..	90·0	1·04	83·5	167	24	14·4	509	68	13·3	
Uspulun	95·5	88·7	1·06	86·2	345	0	0·0	932	0	0·0		96·5	87·7	1·47	85·5	342	0	0·0	1,208	0	0·0		97·0	91·5	1·08	85·0	340	0	0·0	1,080	0	0·0	

Table 2—continued.

Treatment.	Velvet Chaff.												Solid-straw Tuscan.												College Hunter's.											
	Percentage Germination.				Plants.			Heads.					Percentage Germination.				Plants.			Heads.					Percentage Germination.				Plants.			Heads.				
	In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total	Smutted.	Percentage smutted.			In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.			In Laboratory.	In Field.			Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.		
		First Count.		Mature Plants.										First Count.		Mature Plants.										First Count.		Mature Plants.								
		%	P.E. ±											%	P.E. ±											%	P.E. ±									
Control	..	86·0	1·60	85·5 171	0	0·0	533	0	0·0	..	80·5	1·20	81·5 163	14	8·5	594	53	8·9	..	86·0	1·38	84·5 169	35	20·7	535	106	19·8								
Clarke's Protector	73·0	64·2	1·66	45·0 180	0	0·0	631	0	0·0	78·0	62·0	1·44	61·5 246	0	0·0	986	0	0·0	61·5	44·0	1·73	64·7 259	0	0·0	940	0	0·0								
Control	..	87·5	1·44	79·5 250	0	0·0	576	0	0·0	..	86·5	1·14	86·0 172	20	11·6	655	72	11·0	..	86·5	1·24	85·5 171	25	14·6	576	80	13·9								
Bluestone, 1 per cent.	85·5	48·2	1·70	42·5 170	0	0·0	627	0	0·0	71·0	39·2	1·45	41·0 164	0	0·0	817	0	0·0	61·0	39·7	2·04	51·2 205	0	0·0	829	0	0·0								
Control	..	86·5	1·34	85·5 171	0	0·0	517	0	0·0	..	89·0	1·25	82·0 164	18	11·0	625	69	11·0	..	92·0	1·05	83·0 166	28	16·8	582	103	17·7								
Formalin, 1–320	95·0	76·5	1·31	75·2 301	0	0·0	624	0	0·0	99·5	78·2	1·42	76·2 305	0	0·0	1,178	0	0·0	98·0	81·5	1·18	76·7 307	0	0·0	1,165	0	0·0								
Control	..	85·0	1·42	80·5 161	0	0·0	372	0	0·0	..	83·0	1·09	78·0 156	29	18·5	586	115	19·6	..	87·0	1·09	80·5 161	40	24·8	587	147	25·0								
Formalin, 1–480	94·5	81·7	1·53	79·0 316	0	0·0	682	0	0·0	94·0	84·5	1·44	82·5 330	0	0·0	1,261	0	0·0	94·5	85·0	1·02	79·5 318	0	0·0	1,211	0	0·0								
Control	..	82·5	1·35	81·0 162	0	0·0	130	0	0·0	..	82·5	1·27	77·0 154	22	14·2	612	95	15·5	..	87·5	1·09	80·0 160	28	17·5	654	132	20·1								
Hot Water.																																			
6 hr. at 55°, 10 min. at 125° ..	98·0	78·2	1·27	76·2 305	8	2·6	706	18	2·5	97·5	81·7	1·19	81·5 326	24	7·3	1,299	109	8·3	97·5	83·2	0·90	74·0 296	14	4·7	1,224	43	3·5								
Control	..	84·5	1·13	76·0 152	0	0·0	422	0	0·0	..	87·0	1·50	85·5 171	40	23·3	724	185	25·5	..	85·0	1·03	79·5 159	40	25·1	618	148	22·3								
6 hr. at 55°, 10 min. at 127° ..	96·5	73·0	1·54	69·5 278	5	1·8	678	12	1·8	92·0	78·5	1·68	72·0 288	22	7·6	1,162	87	7·4	97·5	74·0	1·69	68·7 275	3	1·1	1,126	10	0·9								
Control	..	86·5	0·98	83·5 167	0	0·0	431	0	0·0	..	81·0	1·36	78·5 157	31	19·7	633	126	19·9	..	90·5	0·82	84·5 169	30	23·1	647	127	19·7								
6 hr. at 55°, 10 min. at 129° ..	88·5	63 0	0·98	65·2 261	1	0·4	686	3	0·4	95·5	75·0	1·35	72·2 289	9	3·1	1,150	37	3·2	97·5	67·0	1·25	61·5 246	0	0·0	999	0	0·0								
Control	..	85·5	1·18	83·0 166	0	0·0	470	0	0·0	..	84·5	1·16	80·0 160	31	19·3	567	125	22·0	..	91·5	1·05	81·5 163	33	20·2	601	115	19·1								
6 hr. at 55°, 10 min. at 131° ..	85·5	43·2	1·85	54·0 216	0	0·0	627	0	0·0	92·0	55·0	1·93	52·5 210	1	0·5	856	4	0·4	91·5	56·0	1·92	42·0 168	0	0·0	809	0	0·0								
Control	..	82·5	..	83·5 167	0	0·0	472	0	0·0	..	85·5	..	81·5 163	20	12·2	575	72	12·6	..	84·5	..	77·5 155	32	20 6	549	106	19·3								

Hot Water.—Seed presoaked for six hours at 55° F., then dipped for ten minutes in water held at temperatures ranging from 125° to 131° F. There was a progressive decrease in smut with increase in temperature of dip, but even at 131° complete control was not attained. The treatments progressively depressed germination and heads, until at 131° both were about 40 per cent. below controls. It appears that the hot-water method does not efficiently control stinking-smut.

All the samples of wheat used were kindly supplied by the Canterbury (N.Z.) Seed Co., Ltd., from the 1926 harvest.

Notes on Infection of Wheat with Stinking-smut.

A striking feature of the series of experiments detailed above is the apparently unaccountable variation in the percentage of plants showing smutted heads when grown from seed dusted with equal amounts of smut spores. During the whole course of the experiments a standard dosage was used of 1 part of smut spores to 750 parts by weight of wheat. The spores were prepared by macerating unbroken smut-balls of the previous season, sifting out the shells, &c., and vigorously agitating with the wheat for five minutes in a closed glass flask. The whole bulk sample of each wheat to be used in the experiments was thus dusted and thoroughly mixed before any was withdrawn for treatment or sowing. Both smut-balls and wheat had been kept thoroughly dry in the Laboratory.

In 1924–25 the smut inoculum used had been collected from various crops in Southland, and was found on microscopical examination to consist entirely of spores of *Tilletia Tritici* Wint.* This produced the following percentages of smutted plants in the controls: Pearl, 1·9; Purple-straw Tuscan, 9·8; College Hunter's, 8·1; and Solid-straw Tuscan, 46·4. The same year a series of plots of 200 seeds of Purple-straw Tuscan were sown at weekly intervals from 17th May to 20th September. These showed a wide range of infection, the percentage curve rising steeply from 1·5 per cent. in the 17th May sowing to 35 per cent. in that of 9th June. Thence, with some violent fluctuations, the curve gradually fell to 14 per cent. in the sowing of 23rd August, and then very steeply to zero in the last sowing on 20th September. (*Journal*, May, 1925, p. 312.)

In the next season's experiments (1925–26) the smut inoculum used was collected from the control rows of the previous year's Solid-straw Tuscan. It was again exclusively composed of *Tilletia Tritici* spores. Mean percentages of smutted plants in the controls were: Velvet Chaff, 19·4; College Hunter's, 21·0; Solid-straw Tuscan, 4·1. The two former were sown on 10th June and the Solid-straw Tuscan on 19th August.

For the following season (1926–27) smut-balls were collected separately from each of the wheat varieties used in 1925–26. In each sifted sample used for inoculum about 0·01 per cent. of spores of *Tilletia levis* Kuehn. were present, the rest being spores of *Tilletia Tritici*. The main sowings of Velvet Chaff were dusted with spores from Solid-straw Tuscan, College Hunter's with spores from Velvet Chaff, and Solid-straw Tuscan with spores collected from College Hunter's. Mean percentages of smutted plants in the controls were: Velvet Chaff, 0·0;

* Species identifications by G. H. Cunningham, Mycologist.

College Hunter's, 17·2; Solid-straw Tuscan, 15·2. A feature of the results with Velvet Chaff is that, while only one smutted plant appeared in the whole series of controls, 0·6 per cent. appeared in the rows treated with Semesan dust, and 2·6 per cent., 1·8 per cent., and 0·4 per cent. in the hot-water treatments at 125°, 127°, and 129° F. respectively. The control rows of Velvet Chaff were all sown on 19th May, but heavy rain prevented further sowing till 28th May, when the Velvet Chaff treatments were sown, followed during the next two days by the rest of the sowings. Among these latter were sown a series of plots (400 seeds each) of each of the three wheat varieties dusted with spores from the three collections at 1 to 750 parts by weight. The results, given in the following table, appear only further to confuse the issue.

Table 3.—Infection Experiments with Stinking-smut.

Method of Inoculation.	Plants.			Heads.		
	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.
Solid-straw Tuscan × spores from Solid-straw Tuscan	324	86	26·7	1,192	340	28·5
Solid-straw Tuscan × spores from Velvet Chaff	327	96	29·3	1,179	371	31·4
Solid-straw Tuscan × spores from Hunter's	326	48	14·7	1,168	176	15·0
Velvet Chaff × spores from Velvet Chaff	325	18	5·5	1,030	63	6·1
Velvet Chaff × spores from Solid-straw Tuscan	322	2	0·6	972	2	0·2
Velvet Chaff × spores from Hunter's ..	325	131	40·3	1,057	410	38·8
Hunter's × spores from Hunter's ..	306	21	6·8	910	64	7·0
Hunter's × spores from Solid-straw Tuscan	319	116	36·3	1,000	381	38·1
Hunter's × spores from Velvet Chaff ..	324	55	16·9	980	190	19·3

Aroma in Tobacco.—"Australian tobacco interests are concerned about tobacco-aroma," reports Mr. T. H. Patterson, Fields Division. "American leaf is the standard for the world. Is aroma due to soil or climate, or do both combine to produce aroma? These are the questions awaiting answers. Sufficient soil was brought from North Carolina, where it is considered the best leaf is grown, to lay down two plots—one fertilized, the other not. Side by side are two plots of Australian soil taken from Bathurst Experimental Farm, where the trials are being conducted, one being fertilized and the other not. The soil is set on concrete, with concrete divisions, to prevent seepage from the soil outside from plot to plot. The cost of bringing the soil was about £200. The Australian leaf aroma is different from that of American, and the smoker looks for the latter, as he is accustomed to it."

Soil Survey in United States.—The total area surveyed in detail to date is 684,451 square miles, and is about equal to the combined areas of Norway, Sweden, France, and Germany. No other country in the world has amassed any such store of knowledge concerning its soil resources.—United States *Agriculture Year-book, 1925.*

FARMERS' RAILWAY EXCURSIONS IN THE SOUTH ISLAND.

Fields Division.

THE institution of interprovincial excursions for farmers in the South Island this year has met with distinct success. Organized by the Railway Department and assisted by the Department of Agriculture, the excursions so far arranged have received excellent support from the farming community, and expressions of satisfaction as to the itineraries followed clearly demonstrate that interprovincial visits are highly popular and profitable.

The first excursion train ran from Clinton to Christchurch on 10th May. Over three hundred farmers, mostly accompanied by their wives, constituted the party. The excursion, which lasted for four days, was intended to show Otago farmers something of the conditions existing in Canterbury, and to this end an itinerary was prepared embracing a visit to Lincoln Agricultural College, the Addington sale-yards, the Belfast freezing-works, and other places of interest to farmers. Canterbury people extended the greatest hospitality to the visitors.

A return of amenities was effected when an equally large body of Canterbury farmers visited Dunedin for four days on 31st May, spending most of their time at the Winter Show and on trips to the Taieri Plain.

Another excursion to Canterbury was arranged for Southland farmers on 17th May, when a large number visited Canterbury, closely following the itinerary followed by the Otago farmers.

A feature which proved of undoubted interest and utility to those travelling by the various trains was the exhibit of an instructional nature which accompanied each excursion. These exhibits were prepared by the Fields Division in Dunedin and Christchurch respectively, and were installed in a second-class carriage, one side of which was fitted with a long show-bench upon which were ranged the articles, charts, &c. These were designed to demonstrate various interesting and instructive phases of farming, and formed a basis for discussion *en route*. The carriage was placed in the centre of the train for ease of access, and during the run officers of the Fields, Live-stock, and Dairy Divisions were kept extremely busy discussing different pertinent matters with the travelling farmers. Competitions were also arranged, farmers being asked to identify twelve specimens of seeds and grasses common to their farms, and so on. (Photos of the demonstration car are reproduced on the two following pages.)

The value of such interprovincial visits is undoubtedly very great from many points of view. The weather on all the trips was most favourable, and contributed greatly to the success of the excursions.

After the above notes were written an excursion of Westland farmers to the Ashburton district of Canterbury took place at the end of June, and a return visit to Westland has been arranged for the present month, the demonstration car and discussions again figuring in the programmes.

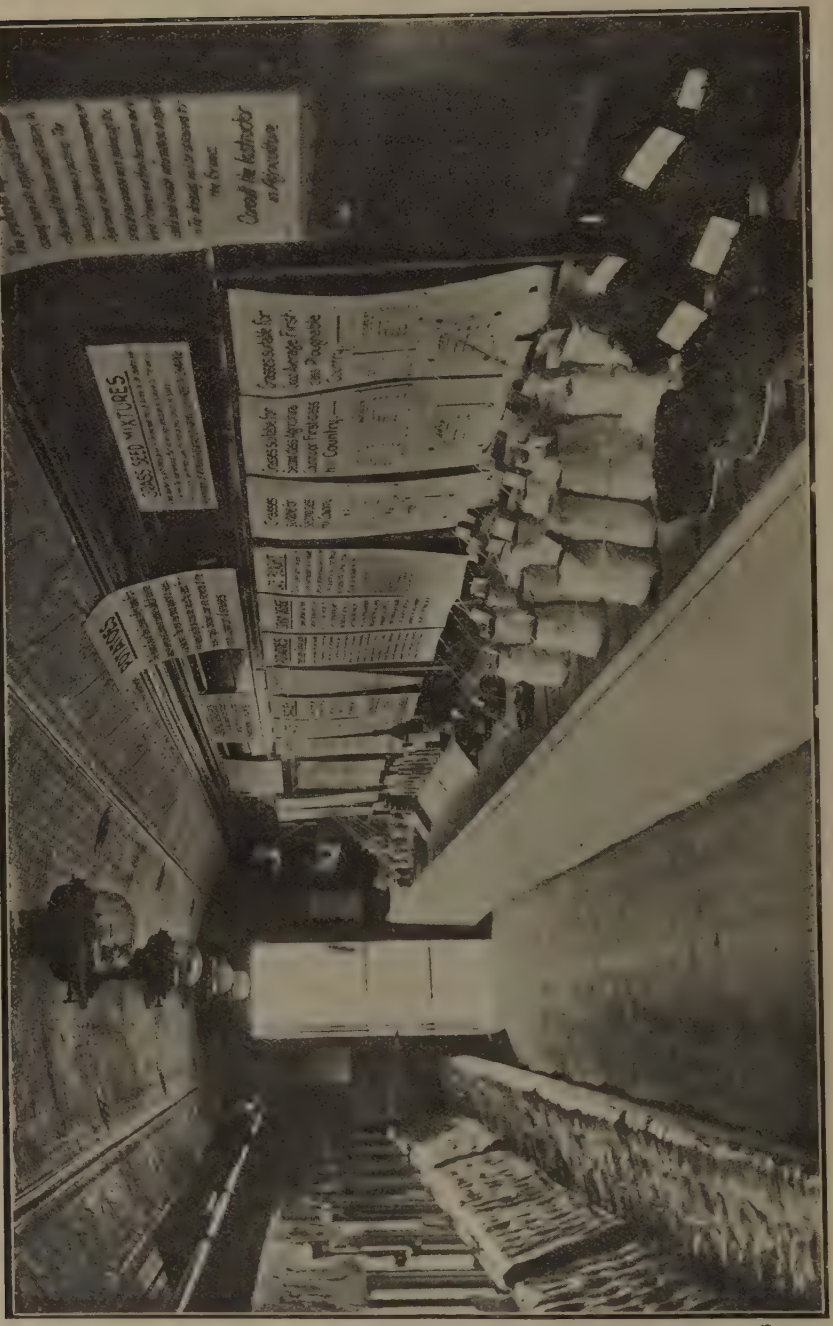

FIG. 1. INTERIOR OF DEMONSTRATION CAR ON THE OTAGO FARMERS' EXCURSION TRAIN, ARRANGED BY THE FIELDS DIVISION, DUNEDIN.

FIG. 2. THE CAR REARRANGED FOR THE CANTERBURY–OTAGO EXCURSION BY THE CHRISTCHURCH STAFF OF THE FIELDS DIVISION.

MANURING OF CITRUS-TREES.

P. EVERETT, Orchard Instructor, Thames.

THE four essential constituents of the soil necessary to the productiveness and general fertility of the citrus orchard are lime, nitrogen, phosphoric acid, and potash. These constituents need to be applied in different forms, different quantities, different proportions of each, and at different times of the year to suit individual orchards. Therefore in dealing with the subject of manuring one can only give a general outline of the principles, from which each citrus-grower should be able to draw up a manurial programme that will be most suitable for his particular grove.

Never has there been any thorough and systematic experiment conducted in this country to fully prove the relative value of the various manures at present in general use in citrus orchards; consequently any recommendations in this direction must be made on the results of experiments conducted in other countries, combined with the practices adopted by successful citrus-growers both in and beyond the Dominion. Any figures supplied or recommendations made in this connection should be taken only as a basis on which to work, each grower taking into consideration the nature of his soil, the manures applied in past years, the health of his trees, and the quality of fruit at present being produced. The successful grower is a lifelong experimenter; each grove should be an experimental station, no matter what the conditions may be. Production of quality and quantity of fruit should be the first consideration, and proper manuring is one of the greatest factors in bringing about these results. Nor should one be satisfied with maintaining the fertility of the soil; in very many cases increasing it is equally as important if success is to be attained.

It is still widely believed that an analysis of the soil is all that is needed to show what manures are necessary to give the desired results. Soil-analysis shows the content of nitrogen in its soluble and insoluble forms, and also the total and "available" mineral plant-foods. The "available" constituents are estimated by their solubility in weak citric-acid solution—an arbitrary method that has proved of great value in determining the fertility of British soils, but the applicability of which to New Zealand conditions has still to be fully demonstrated. Soil-analysis alone cannot serve as a definite index to the manurial programme, although it may provide a useful indication of the lines on which experiments should be conducted in the field.

Every 1,000 lb. of lemons and oranges contains the following:—

	Nitrogen.	Potash.	Phosphoric Acid.
Lemons	1¼ lb.	2½ lb.	1 lb.
Oranges	2 lb.	2¼ lb.	1 lb.

These three constituents combined make what is termed a complete manure, and with the addition of lime no further ingredient need usually be added to give the desired fertility to the soil.

LIME.

Lime has the effect of correcting acidity and mechanically improves the condition of the soil, liberates plant food—especially phosphates

and potash—decomposes organic matter, promotes nitrification and bacterial activity, and generally increases soil-fertility. Although one's soil may be shown to have an abundant supply of lime, it is often profitable to apply more, as lime is often not in that readily available form which is so necessary for the tree.

NITROGEN.

Citrus-trees respond most readily to nitrogen, and this ingredient should never be omitted from the manurial programme except where the trees are already making very vigorous growth and the fruit shows signs of becoming coarse or rough. Nitrogen may be applied in many different forms, but stable or farmyard manure usually gives the best results. However, these natural manures are not always obtainable at a reasonable cost, and when this condition prevails artificial nitrogenous fertilizers have to be resorted to. Dried blood has been found a good fertilizer for citrus-trees, also nitrate of soda and sulphate of ammonia. These three fertilizers are used extensively in citrus groves throughout the world.

GREEN-MANURING.

This practice may also be included in the category of nitrogenous manures. Most soils require humus, and when the natural supply is exhausted it must be replaced if the grove is to be kept in a profitable state. Leguminous plants are most desirable for this purpose on account of their habit of forming nodules on their roots which contain a high percentage of nitrogen. Many different legumes are used, including blue lupins, white lupins, field-peas, golden tares, horse-beans, &c. The blue lupin is probably grown more extensively in New Zealand than any other cover-crop, and has been found to give excellent results on most soils. It is generally advisable to apply a dressing of 2 cwt. or more of superphosphate per acre when sowing lupin-seed; this has been found to greatly stimulate the growth of the cover-crop. In Auckland Province early in April is a suitable time for sowing lupin-seed, and the crop should be ploughed or disked in as soon as the first blossoms show. If lupins are not buried at or before this stage of growth the main stem of the plant soon hardens; consequently decomposition takes considerably longer. Two bushels of seed per acre will give a good cover-crop.

PHOSPHORIC ACID AND POTASH.

In addition to nitrogen, phosphoric acid and potash are required for most soils, and are generally used in citrus groves the world over. Phosphoric acid is best supplied as superphosphate or with organic nitrogen as bonedust; perhaps even better would be a combination of the two. Potash is best supplied as sulphate of potash; muriate of potash is also a good fertilizer.

TIME FOR APPLICATION.

Quickly soluble fertilizers, such as nitrate of soda and sulphate of ammonia, are best applied in three or four equal dressings and at intervals of from five to six weeks. The first application should be made just as the spring growth is commencing. Better results will

be obtained by this practice than when the total amount of these fertilizers is applied at one dressing. With slowly soluble organic nitrogen this need not be practised. Blood-manure is best applied in two dressings, two-thirds being given prior to the spring ploughing or disking, and one-third prior to the autumn ploughing or disking. Phosphatic fertilizers are also best applied in two dressings, but in reverse proportions to those recommended for blood-manure—that is, one-third prior to the spring ploughing or disking and two-thirds previous to the autumn tillage.

A writer in a recent issue of the *Californian Citrograph*, claiming to have had considerable experience in manuring citrus-trees, states that the trees must be well supplied with phosphates in order to secure a heavy bloom of fruit blossoms, and that from experiments it has been proved that a liberal autumn application of superphosphate will ensure this condition. This may or may not be applicable in this country, but, as it is rapidly becoming the general practice in most large citrus groves of Australia, California, and Florida to apply phosphatic fertilizers in the autumn as well as in the spring, we must naturally follow the lead given by these older countries unless later experience teaches us that other practices will give better results.

Potash will probably give best results if applied in the autumn, although if applied in the spring it may be equally as beneficial. It is claimed by certain American writers that if this fertilizer is applied in the autumn, together with phosphates, the effect will be a hardening of the late summer and autumn growth, making the tree more resistant to frost. Whether this is so or not, it is worthy of mention that many of the successful citrus-growers of California are now following this practice of manuring with phosphates and potash in autumn.

QUANTITY OF FERTILIZERS TO APPLY.

The amount of the various fertilizers that it will be profitable for a grower to apply in his grove each year must be largely a matter of conjecture until systematic experiments of this nature have been carried out in this country, and even then the amounts will vary according to quality of soil, quality of fruit being produced, and age and productive capacity of the trees. The tendency of citrus-growers the world over during recent years is to apply a greater quantity of fertilizers each year. What was considered a heavy dressing five years ago is now considered totally inadequate. From personal observations and inquiries in many parts of this country and in Australia, supplemented by reports on manurial experiments conducted in other countries, I am of the opinion that for a lemon or orange grove in full bearing and in a moderately healthy state the following will be a safe basis on which to work out individual manurial programmes, the figures given being for an area of 1 acre :—

	To be applied in Spring.	To be applied in Autumn.
Blood-manure	3 cwt.	2 cwt.
Bonedust	2 cwt.	1 cwt.
Sulphate of potash	..	1½ cwt.
Superphosphate	2 cwt.	4 cwt.

Plus four applications of nitrate of soda at the rate of 1 cwt. per acre. For trees making poor growth or producing undersized fruit the nitrogenous fertilizers to be increased by at least as much again.

All fertilizers should be spread evenly over the entire ground in groves that have been planted for more than three years, and not confined to a circle round each tree.

FURROW-MANURING.

Another very different system of applying manure to citrus-trees is what is known as "furrow-manuring." This system has probably never been tested in New Zealand, but in other countries many successful growers are reported to have adopted it. The method, briefly described, is to make furrows between the rows of trees about 12 in. to 14 in. deep and approximately the same width, then to fill the bottom 6 in. of the furrow more or less with farmyard manure and fill in the top portion with the soil taken out. There are many different ways in which the furrows can be arranged. Probably the best arrangement for the first year is to make the furrows near the tips of the branches on both sides of each row of trees. The furrows for the second year can be made at right angles to those of the preceding year. In the third year the furrows can be ploughed out in the same direction as those of the first year, but farther away from the trees, so as not to disturb the masses of feeding-roots that will be found in the manure applied two years previously. In the fourth year the furrows can be made near those of the second year. The fifth year's furrows should be made in the same position as those of the first year, and during succeeding years the plan of the first four years can be repeated. It is a well-known fact that sowing fertilizers in a citrus orchard has the effect of bringing the feeding-roots very close to the surface of the soil. It is claimed that furrow-manuring prevents this condition, and keeps the feeding-roots well down in the soil where they will not be affected by the drying-out of the surface soil.

It is also claimed that a furrow-manured citrus grove will produce a greater quantity of fruit and fruiting wood, and better-quality fruit, than when given the same manure not buried deeply. Obviously, the amount of manure to be applied in furrows will be governed by the same conditions as in other systems of manuring. In general, about 10 c. ft. of good dairy manure for each tree in full bearing is considered a good dressing. This furrow application of manure is usually supplemented by lime and nitrogenous fertilizers, so as to bring the total amount of nitrogen application for each large and full-bearing tree up to about 3 lb. per tree. Furrow-manuring can be done at any time of the year, but the most popular time is during the autumn months.

Sowing of Pine-seeds.—During the past season a series of sowings of insignis and Corsican pine seeds was made by the State Forest Service in various districts to ascertain the best period for sowing. The results (reports the Service's *Newsletter*) prove that the practice of sowing in October–November cannot safely be departed from. Seed sown too early in the season was slow to germinate, and a considerable wastage occurred, while that sown later than December had too short a period for development before the winter months, and the small plants, not having a sufficient root-system, were lifted out by frosts.

Importation of Cattle.—An application for a permit to import cattle from the United States of America was considered by the Board of Agriculture at its last meeting. The Board decided to recommend that it be declined.

BIOLOGICAL CONTROL OF ST. JOHN'S WORT.

R. J. TILLYARD, M.A., Sc.D., F.R.S., &c., Chief of Biological Department, Cawthron Institute.

[*St. John's wort was referred to briefly in Dr. Tillyard's main report on the biological control of noxious weeds, published in the Journal for February last. The present article is the substance of a special report made to the Australian Commonwealth Government.—Ed.*]

THE problem of the control of this weed is one of special interest to Australia, but may be said to concern New Zealand also, though more for the future than for the present. The St. John's wort (*Hypericum perforatum*), as seen everywhere in Europe, is an annual herb, with a maximum height of about 2 ft., but seldom more than 18 in. The stem is stiff and erect, the leaves green with a slight bluish-green tinge, and covered with tiny transparent dots indicating the presence of oil-glands. The flowers are bright yellow, five-petalled, star-like, borne in large terminal clusters. The plant grows rather late in the season in Europe, young plants not beginning to show up to any extent until June; August and September are the main flowering months, while the seed ripens in October.

This plant is freely grown in gardens, and was probably brought into Australia originally for that purpose. It was introduced into Victoria more than fifty years ago. After a period of acclimatization to its new surroundings it began to spread with amazing rapidity, and at the present time it occupies about 150,000 acres in that State, while smaller but rapidly growing areas of the weed are to be found in South Australia and New South Wales. In New Zealand it was apparently a later arrival and has taken longer to become acclimatized; nevertheless, there are not wanting at the present day disquieting signs that it is beginning to spread in a number of localities, and it is clear that the sooner it is dealt with the better will be the prospects of ultimate control.

The plant produces abundant seed, and appears only to be stimulated by ordinary methods of cultivation. It is dangerous to stock of all kinds, as it contains an active principle which renders the skin exceptionally sensitive to sunlight, causing fever and itching, and resulting finally in bleeding and swollen surfaces from rubbing or scratching. Sheep can eat the young shoots provided they get a plentiful admixture of grass. For small patches of the weed the use of salt is the most effective method of eradication; but this method is far too costly for large infestations.

Generally throughout Europe during the summer of last year this plant, like most others, was remarkably free from insect enemies, the principal cause being the heavy mortality among insects during the late frosts of April and May. In many places, however, especially late in the season, considerable damage by insects became apparent. A study of the various insects causing different types of damage to the plant showed clearly that the genus *Hypericum* possesses a fairly large insect fauna attached to it, and a very large proportion of these insects appears to be entirely confined to the genus.

The assumption underlying this report is that the attempt to control St. John's wort by its insect enemies may safely be made in Australia

and New Zealand, provided that it can be shown (*a*) that the insects recommended for introduction will not feed at any stage of their life-history upon plants other than those of the genus *Hypericum*, and (*b*) that the same insects, if introduced into Australia or New Zealand, have a reasonable chance of controlling the weed.

These two points can be well secured if the same set of regulations already made with respect to blackberry-feeding insects are applied in the case of *Hypericum*-feeding insects also. (See this *Journal*, February, 1927, p. 84.)

The following are the most important species of insects attacking *Hypericum* in Europe :—

INSECTS ATTACKING THE LEAVES.

(1) Chrysomela hyperici and C. varians.—These two beetles are the most noticeable of the insect enemies of *Hypericum*. Both occur widely in Great Britain, *C. hyperici* apparently being the commoner. Both are double-brooded and pass the winter in the adult stage. First-brood larvæ are found in June–July, and second-brood larvæ in August–September. The second brood is known to be oviparous, but the first brood has been stated to be viviparous. This type of life-history is of great importance in considering the probable value of the insect under Australian or New Zealand climatic conditions. In these warmer climates it may reasonably be expected that a race would soon develop with a much shorter hibernating-period, a larger number of broods per annum, and complete viviparity, thus shortening the time between broods. Thus the rate of increase of the insect might become enormous, and the chief problem to be faced would be the possibility of such a ravenous leaf-feeder attacking other species of plants.

Miss Patterson, B.Sc., of Cambridge University, undertook at my suggestion to study these two species as part of her work for her doctor's thesis, and this work was to be continued into 1927. She has already tested the adult beetles, chiefly the commoner *C. hyperici*, on a large number of plants, and so far they have shown complete inability to eat anything but *Hypericum*. They feed most freely on *H. perforatum*, but on the cultivated garden species with larger and tougher leaves (*H. Androsaemum*) they do not thrive at all well. Owing to the great mortality among Miss Patterson's specimens, most of which died during these "starvation tests," the supply of larvae was somewhat limited. She proposes to continue these tests on both beetles and larvæ, and has been asked by me to report definitely, at the end of her work, as to whether these insects do, at any stage, attack any other plants except *Hypericum*, and, if so, what plants.

Assuming, as seems probable, that the experiments at Cambridge give a favourable result for these tests, I am most strongly of opinion that both these species, and, if possible, other allied species found in Europe but not in Great Britain, should be imported into Australia and New Zealand and tested out under strict control conditions in closed insectaries. A liberation of any species of *Chrysomela* in infested areas can only be made after the most exhaustive and thorough tests have been carried out as to the capacity of these insects to attack any other plants of economic value under the new conditions. If

these tests show an entirely negative result, then I believe that these beetles will prove of great value in helping to control the pest.

(2) Anaitis plagiata and A. effumata.—The first of these is a fairly large Geometrid moth known as the "treble-bar"; the second is a closely allied species often confused with it and very difficult to distinguish from it. The larvæ are looper caterpillars which feed voraciously on the leaves and also sometimes in the flower-heads of *Hypericum*.

Although all the text-books give *Hypericum* as the only food plant of these species, yet I have collected a considerable amount of evidence to show that the moths appear very commonly in localities where *Hypericum* is rare or absent. It seems highly probable that the larvæ eat other plants also. Consequently I must stress the importance of original research work being done in England on these species, in order to discover on what plants besides *Hypericum* the larvæ feed. Supplies of *A. plagiata* can be readily purchased from dealers, but I am strongly of opinion that no attempt should be made to introduce this moth or its allied species until a complete series of starvation tests has been carried out.

(3) Actinotia polyodon Cl. (= A. perspicillaris L.).—A Noctuid moth with a voracious larva which feeds on the leaves and flower-heads during July and August and hibernates as a pupa. It does not occur in Great Britain except as an occasional immigrant, but is widespread on the Continent of Europe. It should prove a most valuable aid in checking the weed, but much would depend upon how far it became subject to the attacks of parasitic Ichneumons and Tachinids already present in Australia or New Zealand. Supplies of the pupæ would have to be obtained in Central Europe.

(4) Tineoid Moths attacking Leaves and Shoots.—Quite a number of these are known, including the following species in Great Britain: *Depressaria hypericella, Gracilaria auroguttata, Epinotia hypericana,* and *Aristotelia atrella.* The first-named species spins the shoots together and does considerable damage when abundant; it may be considered of distinct value in preventing flowering of the plant. Much needs to be discovered about the life-history and food plants of these small moths before they could be considered as possible introductions into Australia or New Zealand.

GALL-FORMERS.

Hypericum is attacked by a number of gall-forming species, the most important of which are the Diptera *Perrisia hyperici* and *P. serotina.* Both destroy the flowering-shoots, the former making a rosette of a number of unfolding leaves, while the latter attacks only the two terminal ones. *Perrisia braueri* is exceedingly promising, as its larva stops the shoot while still underground. These insects are commonest in fairly warm localities in Europe, and should do remarkably well in Victoria. As their galls are quite characteristic and confined to *Hypericum,* immediate importations may be recommended, provided that they are received into closed insectaries and subjected to severe food tests before any decision is taken about liberating them. If the

attempt to establish them proved successful I am of opinion that they would almost completely prevent the plant from seeding.

SEED-CAPSULE FEEDERS.

I have seen a larva feeding in the seed-capsules in Central Europe which appears to me to belong to a species of *Apion*, probably *A. brevirostre*, which has been recorded as feeding only on *Hypericum*. Larvæ of *Apion* are most effective in destroying the growing seeds within the pods and capsules, and an insect of this sort, if confined to *Hypericum*, would be of the highest value.

RECOMMENDATIONS.

In view of the above facts, I desire to make the following recommendations :—

(1) That the policy of attempting to control *Hypericum perforatum* in Australia and New Zealand by means of its insect enemies should be officially recognized as a sound policy scientifically, offering very promising chances of final success.

(2) That arrangements be made for as complete a study as possible of the life-histories of *Hypericum*-feeding insects, to be carried out in England.

(3) That starvation tests for these insects be made on all important economic plants common to Europe and Australia or New Zealand (introduced).

(4) That only such species as give negative results in the tests (3) on all plants except species of *Hypericum* should be permitted entry into Australia or New Zealand.

(5) That species brought in should be reared in closed insectaries under the strict control of experts, and that they be subjected to further starvation tests on Australian or New Zealand plants of economic importance.

(6) That only such species as (*a*) give a negative result with these latter tests, and (*b*) appear from their habits in the insectary to promise useful results in controlling *Hypericum*, should be finally experimented with in infested areas in the open.

ACKNOWLEDGMENTS.

I desire to thank Dr. J. W. Heslop Harrison, of Armstrong College, Newcastle-on-Tyne, and Mr. H. C. Richards, M.A., of Brasenose College, Oxford, for valuable assistance in completing the list of insects known to attack *Hypericum*.

"We must encourage and extend methods of timber-cutting which perpetuate the forest while harvesting its products; we must plant trees in abundance on our idle land where they can profitably be grown; we must examine taxation practices that may form economic barriers to timber-culture; we must encourage the extension of forest-ownership on the part of municipalities, counties, and other local governments; and we must take common counsel in public meetings to the end that the forestry problems of each region may be well considered and adequately met."—*President Coolidge.*

GORE EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1926–27.

R. McGILLIVRAY, F.L.S., Instructor in Agriculture, Invercargill.

FROM the demonstrational aspect the season of 1926–27 at the Gore Experimental Area may be said to have been a record one. From October right on until May hardly a day passed without some one interested in the work visiting the area. At times farmers came in parties, and during February a field-day arranged by the Gore Branch of the Farmers' Union was largely attended. The season's programme was a fairly comprehensive one, but manurial trials and investigations of certain plant-diseases under field conditions received prominence.

OAT-SMUT CONTROL.

An experiment on the incidence of smut in oats under several different seed-treatments was watched with interest. The experiment was arranged in four replicated plots, representing (1) bluestone, (2) formalin, (3) hot water, (4) control. The result, as ascertained in January, was an appreciable amount of smut in the controls, a trace in both the bluestone and formalin treatments, while the hot-water treatment gave a crop that was clean throughout and more vigorous in growth than the others.

POTATO-SELECTION AND DISEASE-CONTROL.

A considerable amount of work was undertaken in connection with the potato crop. The selection of a pure line of the Up-to-date variety has been carried a stage further, and the foundation stock at Gore is now probably 100 per cent. pure. This line will be planted next season, and it is hoped to have a considerable quantity on hand in 1928. There has been considerable demand for this seed, but it has been impossible to distribute any this season.

In the control of corticium disease further work was undertaken by Mr. J. C. Neill, Field Mycologist. A number of new dry-powder treatments were tried, but none of these proved at all effective. The continuation of last year's treatment of the tubers with mercuric chloride and hydrochloric acid proved highly satisfactory, however, and these potatoes were a splendid sample. Definite yield trials will be undertaken next season, when the clean potatoes will be tested against seed affected with corticium.

LIMING DEMONSTRATION.

Two blocks of Scotch tares and oats, sown at the rate of 1 bushel tares to 2 bushels oats, gave a further demonstration of the value of lime under Southland conditions. One crop was grown on a part of the area that had received 2 tons carbonate of lime per acre, while the other was on unlimed land. Both crops were manured with super and Ephos phosphate at the rate of 1 cwt. per acre of each fertilizer. The difference in growth was very much in favour of liming. The

weight of hay on the limed block was 2·7 tons per acre, while on the unlimed area the hay-weight was only 1·5 tons per acre. Small birds caused much damage to the oats. The experiment was a useful one, and of much interest to those concerned.

SWEDE AND TURNIP TRIALS.

A considerable area was under various swede trials. The first was a variety trial conducted to ascertain yield per acre and possible resistance of individual varieties to disease (dry-rot and club-root). The crop throughout was manured with superphosphate at the rate of 2 cwt. per acre. All varieties were weighed and carefully examined. Vilmorin's Purple-top White swede gave a result showing over 84 per cent. of bulbs free from disease. The quality of flesh was good, and the swede was a strong grower, but had badly forked roots. Other varieties showing disease-resistance were Studsgaard and several Bangholm strains. The yield of Vilmorin's swede was over 41 tons per acre, this being 8 tons over any other variety in the trial. Several varieties did not produce any bulbs free from disease.

A block of about 4 acres was devoted to a super and super-and-potash test. In the early stages of growth the potash plots were considerably in the lead and could be picked out without any difficulty. In the weighing, however, the yields were found to be very even, results being as follows: Super (2 cwt.), 27·2 tons per acre; super (2 cwt.) and 30 per cent. potash (1 cwt.), 27·7 tons per acre.

A manurial trial of Crimson King swedes in which various phosphates were used was closely watched by farmers. In this trial single plots only were arranged, as there was not sufficient land available for replications; therefore the weights could not be compared in the usual way. All fertilizers were applied at the rate of 2 cwt. per acre. Results were as follows: Super, 25·0 tons; Nauru phosphate, 19·6 tons; Ephos phosphate, 27·7 tons; Seychelles phosphate, 21·2 tons; basic slag, 21·1 tons. Requests have been received for a continuation of this test next season. This will probably be done, but the number of plots will have to be increased so as to overcome soil variations.

A manurial trial of yellow-fleshed turnips was undertaken in connection with the disease investigations in progress at Gore. Irvine's Disease-resistant was tried out against Sharpe's Green-top Yellow, an ordinary commercial line which was used as a control. The manurial treatment consisted of (1) super, 2 cwt. per acre; (2) super, 2 cwt., and 30 per cent. potash salts, 1 cwt., per acre. The experiment consisted of two drills of each manurial treatment, and was replicated twenty-two times. Results were as follows:—

Variety.	Super.	Percentage free from Disease.	Super and Potash.	Percentage free from Disease.
	Tons.		Tons.	
Irvine's Disease-resistant ..	22·5	73·3	27·7	80·5
Sharpe's Green-top Yellow ..	22·0	72·9	28·0	82·0

This experiment was carried out on land that was used for oats and tares last year. Irvine's special turnip did not show any greater

immunity than Sharpe's Green-top Yellow. The crop throughout was a very nice one and has stood much feeding.

MANGOLD TRIALS.

The mangold block proved of interest to many visitors. Mangolds are not grown to any extent in Southland, but experience at Gore has shown that quite good crops of sound roots can be produced at a cost little higher than in the case of turnip-growing. A number of varieties were tested, and Sharpe's Selected Long Red Mammoth (34·62 tons per acre), Improved Large Yellow Globe (31·54 tons), and Dana Ovoid Giant (29·91 tons) were the heaviest yielders.

Part of this block was set apart as a manurial trial. The variety used was Golden Globe, and the treatments were—(1) Superphosphate, 2 cwt. per acre; (2) super, 2 cwt., and 30 per cent. potash salts, 1 cwt., per acre; (3) super, 2 cwt., 30 per cent. potash salts, 1 cwt., and dried blood, 1 cwt., per acre. These fertilizers were used in alternate drills throughout the experiment. At time of thinning, the plants that had received No. 2 treatment showed an increased top growth when compared with those that had received super only. The crops were weighed during the early part of June, with the following results: Super, 20·22 tons per acre; super and potash, 21 tons; super, potash, and blood, 22·35 tons.

CHOU MOELLIER.

The chou-moellier manurial-trial block at time of sowing was very badly infested with grass-grub. The manuring was as follows: (1) Superphosphate, 2 cwt. per acre; (2) basic super, 2 cwt.; (3) super, 2 cwt., and blood, 1 cwt.; (4) super, 2 cwt., blood, 1 cwt., and 30 per cent. potash salts, 1 cwt. Germination was good throughout, but

THE CHOU-MOELLIER CROP AFTER FEEDING OFF.

The two even rows on left are those in which potash was included in manurial mixture. Other rows uneven, caused largely by grass-grub damage.

the grass-grub did a great deal of damage in all plots except those in which potash salts were used. It was very noticeable that in the potash plots the growth was even throughout, while in the others many of the plants failed to make reasonable growth. The outstanding feature, indeed, was the greatly increased size of the plants where potash was used. At time of weighing they were, on an average, at least 18 in. higher and had more robust stems than the others. Fourteen replications of the experiment were made, and the average weight-yields for the various treatments were as follows: (1) 10·8 tons, (2) 15·5 tons, (3) 14·4 tons, (4) 22·0 tons, per acre.

PERMANENT PASTURE.

The permanent-pasture block of 3 acres laid down last October is establishing well. One-third of the block was limed prior to laying down the pasture, and super at 2 cwt. per acre was applied when the mixture was sown. The grass made good headway, and grazing was commenced early in January. It was very noticeable throughout the season that the sheep frequented the limed part of the block to a much greater extent than the unlimed portion.

FERTILIZERS AND SEED-GERMINATION.

It may be of interest to mention that in the case of all crops grown last season the germination was extremely good. Farmers have at times complained of poor germination when using the same fertilizer mixtures as were used this season on the Experimental Area. In all cases the procedure adopted when ridging is to apply the greater part of the fertilizer through the front spouts; in the case of potash salts and dried blood this material is applied from the front box of the ridger and does not come in direct contact with the seed at all.

The Overseer, Mr. James Sleeman, again carried out his many duties in an able manner, and great credit is due to him for the excellent condition in which the various plots were kept.

THE THREE-HORSE TEAM AT GORE AREA.

SEASONAL NOTES.

THE FARM.

TILLAGE AND EARLY CROPS.

In a number of districts the rainfall has been fairly heavy and constant this winter, and in consequence tillage has been held up, more especially on the heavier soils; but, no matter how urgent the case may be, work should never be attempted on average land while in a sodden condition, even if cropping plans have to be altered. The texture of many classes of soil is easily spoiled and generally difficult to recover if so treated. However, no opportunity should be neglected when conditions permit to make up for arrears of work.

Land intended for spring-sown cereals should receive first attention. Suitable varieties of wheat may be sown during August, followed by oats and barley—dates as between August and September being governed by local conditions. The seeding, of course, should be rather heavier than for autumn sowing. Seed should be previously treated with copper carbonate, formalin, or bluestone for the control of fungus diseases. The crust formed by winter rains on autumn-sown cereal crops should be broken up with the harrows. This will leave a soil mulch which will dry quickly, leave the surface in a loose condition, and help to prevent the moisture, rising from below, reaching the surface and so being lost by evaporation.

In planning for useful autumn fodders past experience should guide the farmer as to requirements. In localities where there is risk of shortage of pasture ample provision should be made, choosing a portion of crops that may be turned into hay or ensilage later if not required earlier. Crops such as oats and tares, Western Wolths, ryegrass, and clover, millet, maize, &c., although primarily intended to tide over late summer or autumn requirements, can be conveniently utilized and stored for future use, according to variety, either as hay or ensilage. The provident farmer always overestimates the requirement of his stock and underestimates the yield of his crops.

Where root crops are to be grown in the spring after grass, the land should be ploughed as soon as conditions are favourable. A frequent stirring with the tine harrows is of great value in conserving moisture and checking weed-growth. For mangolds the grass should be skim-ploughed, the sod well disked, and this followed by a deep cross-ploughing. By these means the rotting turf becomes well associated with the soil.

In the case of all spring-sown crops superphosphate alone, or in combination with certain other manures, should be used. A quickly soluble phosphate is necessary so as to ensure vigorous early growth.

PASTURES.

In the North and other early districts spring top-dressing may be commenced during the coming month. Where lime was applied in the early winter, a dressing of 2 cwt. superphosphate will give the pasture an early start. Where heavier and moister conditions obtain,

and liming has not been done, basic super will generally be better. In all cases, whether before or after top-dressing, the vigorous use of the tripod harrows is invaluable in pasture-management.

Young grass should be very carefully treated at this time of the year, because the roots have not yet become firmly established, and close continual grazing will mean lack of vigour later on. Sheep, with their close feeding, are especially harmful if left on the pasture too long. In one sense they are the best for feeding down young grass, because they tread the ground evenly and their manure is well distributed, but their grazing should be managed with care. There is always a temptation to allow stock to graze too closely at this time of the year, but the farmer who can save his young grass by utilizing catch-crops, or by feeding out hay and mangolds on dry pastures, will reap the benefit later on.

LIMING.

In South Otago and Southland lime should be put on the land during July and August, so that its beneficial action may be experienced during the ensuing spring. On the heavy raw types of soil ground burnt lime can be most advantageously used, dressings of 15 cwt. per acre generally sufficing. On the lighter lands carbonate of lime (finely crushed) is advised, to be applied at the rate of 30 cwt. per acre. The practical soundness of liming in these districts is well recognized, and the present cheapness of lime should be an incentive to local farmers to top-dress a good acreage.

In the Auckland Province where lime is to be applied to grassland the month of July is a favourable time for the operation. The liming should be followed up by a top-dressing of superphosphate during spring. It is doubtful whether such liming is economical at the present time unless phosphates are applied afterwards or mixed with the lime. Lime must not be regarded as a substitute for fertilizer, although most soils are deficient in the former element, and until this deficiency has to some extent been satisfied superphosphate will not give its maximum effect. Those farmers who are in the habit of applying super year after year would certainly benefit by giving their pastures a dressing of 15–20 cwt. carbonate of lime per acre. It would hardly be possible to lime the whole farm in one year, but if, say, one quarter of the area is treated in this manner annually the result should be reflected in better pastures and healthier stock.

LUCERNE.

The cultivation of lucerne should be carried out before growth commences, and a top-dressing of superphosphate, with a little sulphate of potash added, will give a stimulus to the crop. Especially is this treatment necessary where it is intended to take a seed crop. An old stand can be disked if the straight cut is used, or cultivated with an implement having special lucerne points fitted. Young stands should be more carefully treated, although the harrows will do a great deal of good if used during the coming month.

FIELD DRAINAGE.

The outlets of all tile or mole drains should be looked to occasionally and any obstruction cleared away, likewise blocks in open drains. The

advantages of a well-drained field are particularly noticeable in late winter and early spring. Efficient drainage means the comfort and better health of stock, the earlier and better growth of crops and consequent higher yields, the better utilization of applied fertilizers and lime, earlier and greater activity of useful soil bacteria, and better assurance against the effects of dry weather.

—*Fields Division.*

THE ORCHARD.

SPRAYING.

OVERHAUL of the sprayer before the spraying season commences may save orchardists much loss of time and inconvenience later in the season. A thorough examination should be made of the machine, and all damaged or worn-out parts repaired or replaced. The moving parts of the pump and engine should be thoroughly cleaned and re-greased, and the hose examined and tested. A supply of spare parts for repairs in case of emergency during the season should be obtained.

The first essential in treating insect or fungoid diseases is that the grower should correctly identify the pest and know something of its life-history, in order that it may be correctly classified and the proper remedies applied for its control. Of the many books published with reference to this subject which would be an acquisition to an orchardist's library, if he has not already copies, are "Fungous Diseases of Fruit-trees in New Zealand," by G. H. Cunningham, and "Manual of Fruit Insects," by Slingerland and Crosby.

The remedies most commonly used are briefly as follows:—

(1) Poisons for chewing or biting insects: An arsenical poison (arsenate of lead) which acts upon the stomach is the specific in general use for the control of codlin-moth, leaf-roller caterpillar, and pear or cherry slug, &c. Such sprays should be applied to the foliage and fruit just before the pest is due to make its appearance.

(2) Contact sprays for sucking-insects: The insects must be present when these sprays are applied, and the specifics are most efficient when they come in contact with the bodies, or are inhaled through the breathing-organs of the insects. At the present time lime-sulphur, Black Leaf 40, and red oil are in most general use as contact sprays for the control of red mite, apple leaf-hopper, aphis (woolly, green, and black), and scales.

(3) Fungicides for the control of fungus diseases: The specifics should be applied before the spores of the fungus have an opportunity of establishing themselves on the plant or fruit tissues. Lime-sulphur, bordeaux mixture, and precipitated sulphur are the fungicides in most common use for the control of black-spot, powdery mildew, leaf-curl, brown-rot, and other fungus diseases.

(4) The use of the secateurs and the saw for cutting out, where practicable, parts of trees badly damaged by insects, fungi, or bacteria.

A full detailed spraying schedule was published in the *Journal* for August and September, 1926.

CULTIVATION.

If the land has not already been ploughed every effort should be made to complete this work as soon as possible, so that cover-crops, grass, and fallen leaves, &c., may be turned in. This will give the material time to rot and be made available when the tree requires it in the summer, while the fruit is maturing. Leaves affected by disease, such as black-spot, will be buried and have rotted, thus preventing the dissemination of disease from this source during the spring.

GRAFTING.

This operation is done in spring when the sap has commenced to rise in the stock. Scions for grafting are usually selected as soon as the growth is dormant, and stored away in a cool, damp place, which should not be wet; or they are heeled into a similar position, where they are kept until the stocks are ready to be grafted in spring. Where cool-storage facilities are available it is recommended that the scions be placed in a chamber having a temperature a few degrees above freezing-point. The leaving of the scions on the trees until just prior to bud-movement is recommended in some quarters, and has been practised with good results.

FERTILIZERS.

Those growers who intend using fertilizers in the orchard during the coming spring should order their supplies now, so that these may be on hand when the time comes to apply them. In districts which experience dry springs and summers the fertilizers should be applied this month. In normal soils from 5 cwt. to 7 cwt. per acre of fertilizer should be sufficient, and in the lighter and poorer soils as much as 12 cwt. will be required for bearing trees. Particulars of manures and their application were given in these notes for May and August last. The fertilizer should be broadcast evenly throughout the orchard, or over that portion of it which is to be treated.

PLANTING.

Growers intending to plant in the spring should arrange for early delivery of the trees, and on their arrival they should be heeled into a suitable place on or near the ground, ready for planting toward the end of August. The ground should be reasonably dry, and, if wet, the planting should be delayed until a later date, when the soil is in a suitable condition.

SHELTER.

Shelter for the orchard is indispensable. In situations which are subjected to severe windstorms and where a wind-break has not yet been established the matter is of such importance that the present planting season should not be allowed to pass without something being done. Gaps in existing shelter-belts should be replanted.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

Harvesting: Routine work among established trees will consist of harvesting fruits as they become ready. With lemons this should be done as the fruit attains size rather than colour. A silver-green

to light-yellow tinge of the skin is quite a satisfactory colour at which to pick, providing the diameter of the fruit approximates $2\frac{1}{2}$ in. to $2\frac{5}{8}$ in. The fruit should be cut with a small portion of the stem attached, which should be trimmed off at the button, otherwise there is a likelihood of the stem puncturing other fruits on contact in the picking-bag or fruit-case. Care should also be observed in handling the fruit, as any form of skin puncture or bruise rapidly causes its loss. The fruit will, of course, require to be cured and stored to obtain marketable condition, but it becomes a far better marketable article than thick-skinned, tree-yellowed fruit.

Oranges may, with advantage, be allowed to remain on the tree longer than is the present general practice. Sweet oranges in particular should be allowed to hang several weeks after full colour is attained. During this time a certain refinement of the skin takes place, and the fruits take a full flavour. According to variety, Poorman oranges, if intended for sale as preserving-oranges, may be picked as soon as reasonable size together with pronounced colour is attained, as superior preserves are made with fruit in a rather undersized state. The larger fruit intended for sale as "breakfast" fruit should be allowed to hang on the trees until well mature, in which state they will meet with more general approval. This will assist towards popularizing the fruit for table purposes, whereas under-ripe fruits with a bitter flavour tend to restrict sales.

Planting: With the approach of the planting season efforts should be directed towards putting the land in order to receive the trees. Good drainage is essential, as unless this is natural or provided artificially trees cannot be expected to thrive. A thorough working of the soil and first subsoil is also advisable, but should be done uniformly over the whole area, not, as is often considered sufficient, under the trees only. Where the subsoil is disturbed in such a limited area only it really acts as a water-catchment basin, and the trees are harmed rather than assisted. General surface-levels should also be attended to, grading being so done as to prevent depressions likely to hold water.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

HATCHING AND REARING OF CHICKS.

AUGUST is one of the busiest months on the poultry plant, for it is then that the work of hatching and rearing chicks should be carried out as rapidly as possible. No chickens do so well as those which start off when the grass and other plant-life commences to grow, and which have the opportunity of making their chief development as the days lengthen. Late-hatched chicks are usually unprofitable because, in the first place, the needful robustness is seldom or never secured, and thus the proportion of birds which must be culled is unduly high. They are also more subject to adverse conditions than the birds bred in the early spring. It stands to reason that

when hatched in the warm weather, and coming on to the colder months before maturity is reached, the highly bred egg-type of pullet is called upon to face conditions which put too severe a strain on her, especially if she is not protected in every way from climatic extremes of weather.

Hatching stock late in the season is not only against satisfactory development, but means poor egg returns and the encouragement of disease. Therefore, whenever possible, all eggs intended for hatching purposes should be placed in incubators or under broody hens by the end of August, or early in September at the latest. In cases where the natural mother is depended upon for hatching and rearing, the difficulty of securing early chickens is often a vital one, owing to inability to secure broody hens when required. There are two alternatives—either to procure an incubator or secure day-old stock. The latter method is by no means to be despised, especially when the supplier is a man of repute and furnishes a reliable fireless brooder with the chicks.

In connection with the work of brooding, it is most advisable to open up any chicks that die, in order to ascertain if possible the cause of death. Investigations of this kind are not only interesting, but they often give clear proof of the cause and nature of the trouble, and indicate necessary preventive methods. Thousands of chicks die annually through eating long fibrous green material and pickings from curtains, sacking, &c., which roll up in a tangled mass in the gizzard. Much mortality also takes place among chicks when they are supplied with grit or bedded with sand containing a large proportion of glittering mineral particles, which they pick out. These particles accumulate in the gizzard, and death rapidly follows. Many of the brooder losses could be prevented if these injurious substances were kept out of the reach of the motherless chicks that have not attained the age when they can be trusted to look after themselves.

Some of the so-called wheat-pollard containing a high percentage of fibrous material, such as finely ground husks, is also often responsible for heavy losses in young chicks. Several such cases came under my notice towards the end of the last breeding season, when hundreds of chicks from three to five weeks old were lost from no other cause. Although finely ground, the fibrous material contained in the pollard would not leave the gizzard. As a result this organ became packed to its utmost with the fibrous substance, and consequently the chickens died from starvation. Young chicks have not the power to assimilate hard fibrous material, however finely it may be ground. Obviously, to compel young birds to eat any mixture containing a high percentage of this material is simply courting disaster. Unless pollard is known to be the genuine article it should never be included in the ration for birds of any age, and particularly is this the case where growing chickens are concerned.

Brooding Hints.

In artificial rearing the importance of preventing the chicks from being chilled cannot be emphasized too strongly. Chill is the most common cause of bowel trouble, and once this sets in little or

nothing can be done to save young birds. Overheating on the one hand, and underheating on the other, are probably more responsible for chill and its evil effects than all other things put together. Very often when mortality takes place the food, the brooder, or some mysterious disease is blamed for the trouble; but it is safe to say that in nine cases out of ten a chill is responsible and nothing else. The temperature should be so controlled that the chicks can secure that uniform degree of warmth which instinct demands, quite irrespective of what the prevailing weather conditions may be. It is only the person with an observant eye, and one who can anticipate the little birds' requirements, who can really steer safely between the danger of either overheating or underheating.

As to the temperature to be maintained in the brooder, there is no better guide than the behaviour of the chicks themselves. If they are well spread out and look comfortable it may be taken for granted that the heat is correct. On the other hand, if they are seen to be huddling, more warmth is required; while if the heat is too great they will be gasping for breath, with wings spread out to a lesser or greater degree, and thus when they leave the brooder they are highly susceptible to chill. In addition to having a comfortable degree of warmth, the brooder must be arranged in such a way that pure fresh air is available to the chicks at all times. Nature should be followed in this respect. The mother hen not only sees that the young ones are kept under her body in a correct temperature, but the chicks are also given the opportunity of breathing fresh air, that great essential for their welfare.

Of course, chickens may become chilled from causes other than that of an incorrect temperature in the brooder. It is often due to removing them too soon from the incubator, or to giving them too much liberty the first few days. Chicks are most susceptible to chill during the first week, and up to this age they require special care and management. They should be confined to the brooder for the first three days, and then given only a small area to exercise in, otherwise they are apt to lose their bearings, huddle away from the brooder, and receive a chill. Above all, the chicks should be protected from draughts; if they are subjected to a direct draught, whether by day or night, trouble may be expected. A common mistake made is to let the stove or lamps go out on hot days. Remember that the hen gives her brood a warm-up frequently, quite irrespective of the prevailing weather conditions, and this until they have attained an age of several weeks. Do not be tempted to overcrowd the chicks. This is bad enough in any branch of the plant, but it is especially disastrous with the young tender stock. Always remember that a hundred chickens well reared will return a better profit than double the number indifferently cared for.

Leg-weakness.

If the chicks are losing the power of their legs and developing a wobbling walk it indicates they they are huddling at night and require more warmth. This trouble is often intensified by the lack

of sufficient bedding on the brooder-floor, especially when the floor is very smooth. The constant slipping on the smooth surface in their endeavour to secure an inside position, which is the warmest, has the effect of spreading and weakening the delicate legs. On the first sign of this condition being observed additional warmth should be applied, by extra flame in a heated brooder, and extra covering in the case of a fireless brooder. Another preventive method is to first cover the floor of the brooder with a thin layer of chaff—say, ½ in. deep. On this place a piece of single sacking the full size of the brooder-box, and cover this with straw chaff (not oaten chaff) to a depth of about 1 in. This will not only provide a comfortable bed for the chicks and induce them to spread out, but it will also greatly assist in preventing them from slipping, with its consequent bad effects on their legs.

Feeding.

What to feed chicks on is largely a question of local conditions, as there are numbers of mixtures that will give equally good results, and where only a small number of chicks are to be reared the best brands of these foods will fulfil all requirements so far as a grain meal is concerned. Remember that it pays to feed the best preparations quite irrespective (in reason, of course) of their price.

Strict attention to cleanliness is of the utmost importance. The quarters, drinking-vessels, feed-trays, troughs, and litter must be kept clean, that great essential for preventing insect pests and disease from making their appearance.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

EARLY SPRING OPERATIONS.

As spring arrives every advantage should be taken of fine days to examine the hives and to give the apiary a general clean-up. No season is better for this than spring, just at the time when activity begins among the bees. In the process of examination every hive should be opened, one at a time, and its condition noted. See that the queen is present, note the progress made in brood-rearing, and be sure that sufficient stores are on hand to meet the incessant demands of the colony. Should there be plenty of honey still in the combs—say, from 15 lb. to 20 lb.—this will answer, but, if not, artificial feeding will be necessary to supplement the honey coming in from fruit-bloom and early spring flowers. The best way to replenish the stores, if combs of sealed honey from healthy colonies are not on hand, is by the use of a syrup made from the best white sugar. A syrup made in the proportion of one part of sugar to three parts of water can be used. Heat the mixture until the sugar is dissolved, but exercise care to prevent the mixture from burning. Feed inside the hive. For full particulars see Bulletin No. 128, "Beekeeping," published by this Department.

FRAME MAKING AND WIRING.

Frame-making should receive every consideration, and proper nailing must be strictly attended to. There are no short-cut methods to the proper nailing of frames, and neglect in this direction will undoubtedly cause a great deal of worry when the frames are in use, more especially in districts where the bees bring in a great deal of propolis. It is well to take every precaution that there is no danger of the top bar leaving the sides of the frame when manipulating heavy combs.

Strict attention must be given to wiring the frames. Many good combs are broken at the time of extracting through neglect to wire properly, and good wiring will allow the beekeeper to handle the combs freely without fear of the brood and honey falling out of the frame. The end bars usually contain three holes through which to thread wires. Cut the wire in lengths of about 60 in., and thread through the holes, draw tight, and fasten each end with a small tack. Some beekeepers advocate single wires in case the long wire gets broken, but if good wire is used the former method will prove satisfactory.

FITTING FOUNDATION IN FRAMES.

When fitting the foundation in the frames care must be taken to see that the sheets are properly sunk into the groove provided. Slip the sheet of foundation through the wires so that the centre one is on one side and the top and bottom one on the other. Put the foundation in the wide groove, and the wedge, which should be broken in two pieces at least, in the narrow one. Sink the wedge, thus forcing over the tongue against the foundation, which will then be in the centre of the frame. This is a most important matter, as the correct position of the foundation alone ensures even combs. In order to make the foundation more secure a simple operation may be performed by the use of the spur-embedder. This small appliance forces the wires firmly into the foundation. It may be purchased for a few pence at any of the dealers. A good method of securing the wires is to bring into use melted beeswax. The wax when molten may be applied to the wires by means of an ordinary paint-brush. The latter method is quicker, and prevents any danger of the wire cutting the foundation, as sometimes happens when the embedder is used with too much force.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

LAND TREATMENT AND CROP ROTATION.

THE suggestions made in these notes, under this heading, in March last now demand further consideration, as the plans there set out have now arrived at the planting stage. A common practice with market-gardeners and fruitgrowers is to give very heavy dressings of chemical fertilizers before planting or sowing the crop in the spring—sometimes even after heavy dressings of organic manure in the autumn. This treatment is justified, it is considered, by the size and number of crops that are taken from the land, and what is not used by the crop remains in the ground and so forms useful reserves. Crops grown under this treatment are often very good, but there is a great deal of evidence

to show that they would be as good with a much smaller application of fertilizers, and sometimes even better. An amount of 5 cwt. per acre of chemical fertilizers, even without a green crop turned in or organic manures applied, is a good heavy dressing, and needs to be exceeded only rarely on any one occasion. In the spring, before sowing or planting, 2 cwt. or 3 cwt. of superphosphate per acre, and about half that weight of sulphate of potash, is a useful dressing for the land for most crops. The essential ingredients are very soluble and readily available. What else is needed is best given as required, and one accustomed to estimating the condition of crops will very soon decide what that may be. The method of applying moderate doses at intervals—especially when well selected—has proved the best method and more economical. There are cases where a plant will suffer from the application of manures that would be decidedly beneficial at the proper season. The best results, with a greater economy, lie along such lines as the foregoing.

Land under preparation is cleaned by turning in the existing vegetation to rot. After about a fortnight seedlings will make their appearance with twitch and similar plants. A light stroke of the hoe or cultivator on a fine day will destroy these, and after a second or third repetition of the treatment the crop has an excellent chance of getting established with little trouble to the grower, as the weeds are more readily destroyed now before the seed is sown; also the land has time to consolidate, as is necessary for a good seed-bed. There is the further not unimportant advantage of destroying those insect pests which pupate in the soil, thus eliminating them before they can damage the crop.

VEGETABLE CROPS.

The first opportunity should now be taken to complete the sowing of the earlier vegetable crops mentioned last month. Broad beans, peas, lettuce, spinach, cabbage, cauliflower, parsley, onions, short-horn carrots, parsnips, white turnips, turnip-rooted beet, and radishes are all in keen demand, many of them for spring and early summer use. In most districts, on well-drained land, they should be sown as soon as the land is sufficiently dry.

The planting-list includes early potatoes, artichokes, autumn-sown onions, cabbage, cauliflower, lettuce, shallots, garlic, and herbs. Rhubarb may be included, although transplanting is sometimes deferred until after the crop has been pulled. Except in the warmest districts asparagus is best planted next month. Kumaras should be prepared for sprouting.

THE FRUIT SECTION: OUTSIDE AND UNDER GLASS.

The pruning, spraying, cleaning-up, and manuring of established crops should now be completed, also the planting of new brakes of bush fruits. Passion-vines and tree-tomatoes are best planted a little later. Seeds of tomatoes, Cape gooseberries, peppers, and egg-plants should be sown in boxes, and raised on a hotbed in a sheltered position.

Towards the end of August tomatoes and cucumbers are planted out under glass for early summer cropping. During the variable weather of early spring every care must be taken to prevent the

plants becoming chilled. A little ventilation will be required daily, but care must be taken to close the houses early in the afternoon; this is a necessary attention that is perhaps neglected more than any other at this season.

CROPS OF NUTS.

The growing demand for this produce is attracting the attention of planters. In many cases, instead of planting them in large orchards in the usual way, they may be distributed in hedge-rows, on waste ground, or the edge of plantations, or among the decorative planting about the house. The walnut prefers an open alluvial soil; the sweet chestnut, hilly country of fair quality. The hazel crops best on land of fair quality only; and the stone pine (*Pinus pinea*) does not appear to be at all particular as to locality. Although quite a number of these pine-trees have been planted and are in bearing, owners are often unaware that the seeds are edible, and more often still that they are a considerable article of commerce. They are very good.

SHELTER, HEDGE, AND ORNAMENTAL TREES AND SHRUBS.

It is well to remember that the short period during which these plants may be moved is drawing to a close. The end of September is as late as one can plant without serious risk, but it is safer to do it now, particularly if much of that class of work has to be done; to defer it is running too great a risk. After the selection and arrangement of the planting have been carefully studied, a dry soil at planting-time and secure fencing from stock are among the more important conditions necessary.

TOBACCO SEED-BEDS.

A large quantity of leaf ripening at the same time is difficult to handle satisfactorily, especially in the curing-shed and where the whole-plant system of curing is adopted. To spread the harvest period the seed-beds are sown at intervals. It is desirable to start the first in the coming month, in order that the harvest may commence early. The beds should not be more than 5 ft. wide, so that weeding and pulling may be done conveniently. In some cases this early sowing requires the shelter of glass sash-lights, and in some instances it is even given the assistance of a hotbed. Small experimental sowings can be made in seed-boxes in the usual way with annuals, the plants likewise being pricked out when they have made their first pair of true leaves, and allowed to grow till they are 3 in. or 4 in. high and ready for planting in the field.

To get over the difficulty of sowing such a fine seed evenly over a comparatively large area it is usual to mix it with about twenty times its own bulk of sifted wood-ashes, sand, or bonedust. After thorough mixing the material may be evenly distributed and pressed in the ground with a board or light treading, or it may be watered in lightly with a fine rose.

The seed-bed should then be covered with sash-lights, light hessian, or cheese-cloth. A close calico or hessian is sometimes used, but is unsatisfactory, as it creates a close, damp atmosphere

in which slime fungus grows, and the conditions are altogether unfavourable. The cloth is held 8 in. or 10 in. off the ground by a board kerb placed round the bed, with cross-battens at intervals to avoid sagging. Much judgment is required while the seeds are germinating, in order to keep the bed moist and warm while preventing the land becoming wet and sour.

It is also quite time to commence the preparation of the field where the plants are to be grown, if that has not already been commenced. The work is easily and effectively done now; if it is deferred and the plants are put out before the preparation is properly completed it can be neither.

LAWNS AND PLAYING-GREENS.

New lawns will require careful cutting, weeding, and light rolling. The grass must be cut high for the first season to allow the plants to become established.

Old greens will require the worn patches to be mended with suitable turf, the lawns carefully weeded, and a top-dressing of good quality and moderate quantity applied. There is serious danger here of introducing more weeds. Unless the soil used has had at least twelve months' preparation in a compost heap, it is safer to use a clean sand for mixing with the fertilizers for the top-dressing.

—W. C. Hyde, Horticulturist.

OPENNESS IN CHEESE, AND FACTORY HOURS.

SPEAKING on the subject of openness in cheese at the annual conference of the National Dairy Association last month, the Director of the Dairy Division, Mr. W. M. Singleton, said:—

"As soon as the Division's laboratories are erected and the experimental dairy factory is available it will be possible to give greater attention to this question. Some of the openness in evidence is, however, merely that which has always troubled cheesemakers more or less, and is generally recognized to be due to unduly hastened manufacture. Many dairy-company directorates object to the payment of overtime. This has caused their managers to take risks in the process of manufacture which too frequently prove unsuccessful, and open cheese is the consequence.

"In most industries governed by fixed hours and wages for employees it is probably the case that the quantity of output is much in harmony with the number of hours worked. In the manufacture of cheese this is not the case, since the hours worked have little connection with the quantity of milk received, or the weight of the resultant cheese. Furthermore, with slow-working curds, the extra time required consists more of waiting-time than of time spent on actual work. The output per day, therefore, is practically the same whether the hours be normal, or more or less than normal. The difference from the company's standpoint is one of quality.

"Quality in our cheese, with special reference to 'openness,' is so important that one is constrained to suggest that the employers' representatives should strive to get the stipulation of number of hours left out of future awards or agreements in this connection. Provided the number of men for certain quantities of output be stipulated in a manner which is fair and reasonable, the question of hours may, in my opinion, be well left in abeyance. I cannot recall having ever met a manager who kept slow-working curds longer in the vat than he deemed necessary for the making of a close-bodied cheese. Moreover, if the factory-manager and his staff are continually working against time, as indicated by the present system, it is prejudicing the proper training of our factory-managers of the future. The factor of quality in the resultant cheese is being taken much less seriously under the present system than should be the case."

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JANUARY TO JUNE, 1927.

Dairy Division.

OWING to the comparatively small number of cows generally which calve during the first half of the calendar year in this country, it is a more or less natural expectation that the number of animals receiving certificates of record during that period will be comparatively low. In the first half of 1927 thirty-nine cows were granted certificates as detailed in the appended list.

While numerically the list is by no means a strong one it contains several yields of more than average merit. The outstanding record, however, is that of Messrs. H. North and Sons' mature Friesian Rosevale Queen Sylvia Triumph, with a yield of 986·06 lb. butterfat from 23,091 lb. milk produced in 365 days, commencing at the age of 5 years 10·4 days. This cow has two other certificated records, one of 621·23 lb. butterfat in the junior two-year-old class, and the other of 589·60 lb. as a senior three-year-old. Her sire is Rosevale Plus Triumph, who, in addition to Rosevale Queen Sylvia Triumph, has five other C.O.R. daughters. Her dam is Rosevale Queen Daphne, who has gained three certificates of record—a junior two-year-old for 509·82 lb. butterfat, a junior three-year-old for 675·18 lb., and a junior four-year-old for 805·54 lb. Messrs. North and Sons may be congratulated on the breeding and handling for test of Rosevale Queen Sylvia Triumph, who appears to be but one of many cows from a herd of high-yielding, long-distance producers.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Vernon King's Noble Aster	G. R. and H. Hutchinson, Auckland	1 306	240·5	300	7,028·3	418·57
Viola's Golden Life ..	J. Mitchell, Hopelands ..	1 336	240·5	285	6,717·9	376·34
Jenny Lind of Puketapu	T. H. Western, Bell Block ..	2 56	246·1	364	5,766·6	313·60
Beaulieu Goldie ..	A. O. Brown, Kamo ..	1 314	240·5	273	6,017·3	286·13
Three-year-old.						
Superior Girl ..	John Hale, New Plymouth	3 72	284·2	365	9,445·4	515·90
Ursanne Bowlina ..	Martin and Murray, Temuka	3 257	302·7	351	8,308·8	481·77
Snow View Butter Girl	F. Phillips, Otorohanga ..	3 09	283·9	365	8,192·1	423·82
Myrtle Bright ..	S. J. Robinson, Hinuera ..	3 247	301·7	352	7,483·8	385·94
Braeside Bonnie ..	J. Mitchell, Hopelands ..	3 10	278·0	296	6,322·9	382·31
Four-year-old.						
Waipiko Clarity ..	C. G. C. Dermer, Waipiko ..	4 106	324·1	365	12,780·4	634·43
Mature.						
Snow View's Maiden	H. C. Sampson, Hillsborough	6 5	350·0	365	9,866·2	527·62
Orange Dale's Larkspur	W. J. Hall and Son, Matatoki	6 88	350·0	365	8,987·3	520·89
Meadowvale Petrova	S. J. Robinson, Hinuera ..	5 318	350·0	346	8,924·4	513·01

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Pareora Butter Girl Cadilac*	A. S. Elworthy, Timaru ..	2 144	254·9	365	16,491·7	626·43
Totara K. P. Colantha*	Piri Land Co., Auckland ..	2 163	256·8	365	15,503·5	573·94
Merrylea Inka May Griselda*	McDonald and Co., Dunedin	2 156	256·1	365	13,803·8	496·37
Anawhata Hilda Minto Pietertje	P. F. Boucher, Kumeu ..	1 344	240·5	303	8,349·5	309·58
Senior Two-year-old.						
Rouble Pietertje Valdessa*	Hobson Farm, Ltd., Auckland	2 266	267·1	235	8,598·2	348·53
Junior Three-year-old.						
Rosevale Gipsy Abbekerk Posch*	H. North and Sons, Omimi	3 127	289·7	365	16,734·2	523·26
Rosevale Inka Beauty Posch*	H. North and Sons, Omimi	3 80	285·0	365	15,938·0	430·99
Senior Three-year-old.						
Peria Julip Lass ..	Waitemata Stud Farm, Hobsonville	3 189	295·9	192	7,189·6	312·75
Junior Four-year-old.						
Rosevale Kaatje Colantha Posch*	H. North and Sons, Omimi	4 131	326·6	365	19,631·5	634·26
Senior Four-year-old.						
Rosevale Helena Keyes*	McDonald and Co., Dunedin	4 325	346·0	365	13,981·8	380·57
Mature.						
Rosevale Queen Sylvia Triumph*	H. North and Sons, Omimi	5 104	350·0	365	23,091·9	986·06
De Kol Lulu of Hawkridge*	Piri Land Co., Auckland ..	8 19	350·0	365	16,292·1	641·06
Rosevale Princessje*	H. North and Sons, Omimi	6 14	350·0	365	17,114·2	592·40
Cluny Pietje Kate 10th	Piri Land Co., Auckland ..	5 301	350·0	365	16,456·8	584·58
Cluny Princess Buttercup*	Piri Land Co., Auckland ..	5 326	350·0	365	17,892·7	582·61
Rosevale Kittie Posch*	H. North and Sons, Omimi	7 44	350·0	365	16,673·5	511·73
Woodcrest Netherland Pauline	Waitemata Stud Farm, Hobsonville	8 150	350·0	257	15,404·2	504·59
Blanco 4th Flush* ..	W. J. Polson, Fordell ..	7 337	350·0	365	11,689·8	403·93
MILKING SHORTHORNS.						
Junior Two-year-old.						
Vale Royal Sunbeam	Simms and Sons, Halswell..	2 84	248·9	348	5,142·4	255·58
RED POLLS.						
Two-year-old.						
Glen Eden Red Rose	J. G. Donaldson, Stirling ..	1 340	240·5	365	6,798·5	296·69

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Second-class Certificates.						
Jerseys.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Daphne of Stonycroft	S. Unwin, Winchester ..	2 27	243·2	365	5,172·2	318·45
Mature.						
Bilberry's Nettie ..	J. R. Colson, Waihou ..	5 12	350·0	365	10,896·5	547·38
Friesians.						
Junior Two-year-old.						
Totara Lulu de Kol ..	Piri Land Co., Auckland ..	2 6	241·1	365	13,821·7	503·39
Junior Three-year-old.						
Ryvington Ruby ..	Mrs. A. M. Hodgson, Tamahere	3 28	279·8	364	12,263·3	407·68
Mature.						
All Dutch Queen ..	W. H. Madill, Auckland ..	10 250	350·0	365	19,867·4	796·02
Nepean Royal Colantha Pietertje	J. J. Walker, Ohangai ..	6 41	350·0	365	13,715·6	534·08

FLOSS OF BRAESIDE (R. W. D. ROBERTSON, NEW PLYMOUTH).

C.O.R., 1926, in Ayrshire mature class: 14,907·4 lb. milk, 678,88 lb. butterfat.

REVIEW.

"PLANT NUTRITION AND CROP PRODUCTION."

SIR JOHN RUSSELL, Director of the Rothamsted Experiment Station, Harpenden, England, was the fifteenth annual lecturer selected to deliver the Hitchcock lectures at the University of California, U.S.A., in 1924. These lectures have now been published (University of California Press, Berkeley, California, and Cambridge University Press, England, 1926) under the title "Plant Nutrition and Crop Production."

It goes without saying that the book is intensely interesting to students of agriculture. Sir John Russell has the happy knack of treating historical matter with freshness and originality, and when he takes one back to 600 B.C. or to A.D. 1620, or to other experiments of the seventeenth, eighteenth, and nineteenth centuries, it is all with the purpose of showing how the theories now held were laboriously built up, and each illustration fits beautifully into the scheme of his ordered instruction to his American audience. Treated in the lecturer's easy style the description of the development of the theories concerning agricultural chemistry centring round the great names of Liebig, Lawes, Gilbert, and Boussingault makes eminently good reading. The rise of the artificial-manure industry, and particularly that of the great superphosphate trade, reads like a fairy-tale. Sir John concludes: "It is not too much to say that the discoveries and developments of artificial fertilizers have been one of the great factors in the making of modern Europe."

To review the whole field of his subject the lecturer has, in 115 octavo pages, succeeded beyond expectation. Sir John has much to say on nitrogen and soil bacteriology worthy of close attention, but on the questions of special interest to New Zealand students he must be fully quoted: "Probably the most dramatic effects, however, are those produced by minute quantities of certain elements, iron, boron, manganese, and a few others, on the growth of plants supplied with a complete nutrient solution. Small quantities of manganese were found by Bertrand to be essential to plant growth. Boron is being studied at Rothamsted, the investigation having originated in an observation made when the entomologists were adding various poisons, including borax, to soil in which broad beans were growing, in the hope of making the plant unsuitable to the *Aphis*. Borax markedly increased the plant growth, and when the botanical staff took the matter up they found that the old 'complete' nutrient solution would not allow beans to develop unless a trace of borax was supplied. Mazé, of the Institut Pasteur, Paris, has added other elements, iodine, zinc, aluminium, &c., to this remarkable list. The subject is under investigation by Dr. C. B. Lipman. The analogy with vitamins is obvious, but analogy is the most treacherous method in science."

The difficulties of the investigator in getting his theories translated into farm practice are thus touched upon: "We shall find this to be the usual course of events. The first workers obtained much knowledge rapidly; then comes a period when progress apparently ceases and confusion reigns instead. Suddenly the generalization appears, and sooner or later thereafter the practical application. Then comes the large-scale test, the criticisms, and the curious and inexplicable observations of the practical grower. And although we who are working in the experimental stations may sometimes be tempted to feel that these observations, being unknown to us, cannot possibly be true, nevertheless, they often are true, and contain the germ of highly interesting scientific problems, sometimes, indeed, the key to further progress. We shall see in later lectures how history is repeating itself in other branches of science. But progress is always slow, and we can never see the whole of anything in nature; as Browning said, 'We explore with a taper and not with a torch.'"

Finally, the lecturer summarizes what is known regarding soils and their classification. Soils contain two phases: (1) mineral, from the rocks; (2) organic, from the decay of plants. In humid, cool conditions, as in New Zealand, the silicates of the rocks break down to form soils rich in silica; but in wet tropical conditions the silica is washed out, leaving only aluminium and iron oxides; and under still wetter conditions the aluminium is also washed away,

leaving the laterite red soil (chiefly iron compounds) of the tropics. The nature of the organic matter is determined by the vegetation from which it arose and the kind of decomposition to which it is subjected, both of which are dependent on the climate. Hence the soil is very much the child of the climate. An actual confirmation of this has been effected by American investigators who transported a soil from one district to another with different climate. In seven years considerable alteration was found in its composition.

The first great division of soils is therefore into the laterite and silica soils. The second great division is determined by the presence or absence of reactive calcium. "In the realm of nature it is remarkable how exceedingly important certain elements are in comparison with others. Probably no single element plays a greater part in the soil economy than does calcium. The whole flora of a soil, its agricultural possibilities, and therefore the comfort and well-being of the agricultural community that dwells upon it, are all profoundly affected by the consideration whether it does or does not contain reactive calcium. A third great soil division depends on the fate of the organic matter; in the normal case it mingles with the soil, being drawn in by earthworms, ants, or other animals; but when mingling agencies are absent it lies on the surface and forms peat, fen, or muck soils."

The lecturer proceeds: "Time does not allow of consideration of the laterites, the peats, or the fen soils. We are concerned mainly with a great middle region . . . where the decomposition products have persisted so that colloidal substances are present; where there may or may not be much reactive calcium, but where there is invariably organic matter, the remains of older generations of plants, which have decomposed so far as to reach the steady state . . . Reference has already been made to the fact that some of the soil constituents are in the jelly-like or colloidal condition. The soil particles are pictured as being coated with jelly just as if they had been steeped in it. The study of the soil colloids is one of the triumphs of modern times, and is furnishing the explanation of many important soil properties which had previously been wholly inexplicable." The lecturer's scheme of soil classification is illustrated by a very interesting chart.

The book is well printed, and the illustrations are admirable, but the absence of an index is a distinct blemish.

B. C. A.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 19th May to 30th June, 1927, include the following of agricultural interest:—

No. 56034: Farm-implement lifting-device; S. Upritchard, Arundel. No. 56645: Weed-destroyer; P. Allsop, Frankton Junction. No. 58211: Sheep-shearing-machine comb; F. G. W. Bristow, Sydney, N.S.W. No. 56595: Wool-pack; R. F. Smaile, Dunrobin. No. 58243: Milking-machine pulsator; D. F. and N. H. Watson, Waitoa. Nos. 55675 and 58390: Cattle-food; J. Jensen, Hamilton. No. 57663: Portable butter-collectors; J. O'Connell and H. H. Kerr, Kensington, Victoria. No. 57995: Sheep-shear hand-piece; G. F. Hight, Auckland. No. 58284: Correction of wind-sucking in horses; F. L. Eastgate, Christchurch. No. 56319: Cream-separator drive-pulley; W. Scott, Christchurch. No. 56458: Milk-pipe fitting; O. A. M. Randrup, Hamilton. No. 56734: Pasteurizer; Wilkins Ltd., Invercargill. No. 56959: Cheese vat tap; J. M. Collins, Hawera. No. 57486: Milk-testing appliance; G. S. Thomson, London. No. 57979: Plough-lift; B. McKay, Mayfield. No. 58504: Pasteurizer; E. D. Berry, Palmerston North.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

Chilean Nitrate Organization.—The Chilean Nitrate Committee of Valparaiso and London advises that for reasons of economy it is closing several of its delegation offices, including that for Australia, New Zealand, and the South Sea Islands, with headquarters at Sydney. Supplies of nitrate of soda will be obtainable as usual, however

WEATHER RECORDS: JUNE, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE percentages of rainfall, compared with the means of former years, were heavier in the northern and east coast districts of both Islands, and, as usually happens when the balance falls on the eastern side, the western and southern districts experienced lighter rainfalls than usual. In Poverty Bay, Hawke's Bay, and parts of North Canterbury the falls were over 100 per cent. in excess of the average, and in these east coast districts were generally welcomed, for rainfall has been less than the usual for some time. On the west coast of the South Island the deficiency was from 20 to 70 per cent. below the mean for former years.

During the first week of the month anticyclonic conditions prevailed—bright days and cold nights. The barometer fell rapidly on the 6th and 7th, and was accompanied by strong north-easterly winds, which were severe, particularly in Otago. A westerly depression held sway during the following week, with very unsettled and cloudy weather, and about the 12th ended up with a smart southerly, which brought a wintry snap with falls of snow on the 11th, 12th, and 13th. The barometer continued high for three or four days, and then fell for two days. This depression ended with a severe south-easterly, which prevailed, particularly in the northern and east coast districts, being accounted for by a cyclonic disturbance from the north encountering an anticyclone which held sway in the south. Unsettled weather followed until the end of the month; and some very severe frosts were recorded in Otago and Southland on the 19th, 20th, and 21st, being regarded as the hardest for over forty years. Frosts were recorded in Christchurch on twenty-two mornings, and many places inland in the North Island also recorded frosts on fourteen or fifteen mornings in the month. The Albert Park Observatory in Auckland recorded frosts there on the 14th, 15th, and 16th.

Temperatures were again below the mean for former years, and more so than in May. There was also very little wind, excepting from the three storms mentioned above. Although conditions were cold and changeable, they were, on the whole, fairly seasonable.

RAINFALL FOR JUNE, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	6·12	15	1·58	5·53
Russell	6·65	12	3·60	6·99
Whangarei	8·01	15	2·17	5·51
Auckland	7·09	18	2·50	4·91
Hamilton	4·27	20	0·70	5·19
Kawhia	6·41	20	1·04	5·46
New Plymouth	6·35	16	1·46	6·20
Riversdale, Inglewood	6·69	17	1·38	10·31
Eltham	4·84	23	0·97	5·46
Whangamomona	4·49	18	1·05	7·92
Tairua	7·12	17	1·84	6·95
Tauranga	6·44	15	1·50	5·42
Maraehako Station, Opotiki ..	7·80	11	3·01	5·99
Gisborne	10·56	17	2·24	5·28
Taupo	7·40	10	1·60	4·35
Napier	8·00	18	2·10	3·59
Maraekakaho Station, Hastings ..	7·50	17	1·86	3·33
Taihape	3·85	18	0·87	3·85
Masterton	7·91	21	1·93	3·48
Patea	4·15	15	0·62	4·40
Wanganui	3·84	12	1·30	3·19
Foxton	3·60	12	1·04	2·96
Wellington	5·44	17	1·92	4·87

RAINFALL FOR JUNE, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	3·55	17	0·58	7·53
Greymouth	5·28	15	1·03	8·27
Hokitika	4·33	14	0·82	9·60
Ross	4·49	10	0·95	9·20
Arthur's Pass	3·01	6	0·96	10·12
Okuru, Westland ..	9·38	6	2·70	10·76
Collingwood	9·17	14	2·23	11·33
Nelson	3·00	12	0·83	3·69
Spring Creek, Blenheim	2·91	12	1·32	3·01
Tophouse	3·48	11	0·95	4·75
Hanmer Springs	3·32	14	0·96	3·05
Highfield, Waiau	3·28	11	0·86	2·49
Gore Bay	5·15	14	0·86	2·34
Christchurch	3·61	14	0·82	2·66
Timaru	2·62	10	0·92	1·70
Lambrook Station, Fairlie ..	1·68	2	1·34	1·91
Benmore Station, Clearburn ..	0·77	7	0·50	2·06
Oamaru	3·06	9	1·08	2·01
Queenstown	0·53	5	0·34	2·46
Clyde	0·50	3	0·33	0·98
Dunedin	2·61	10	1·35	3·15
Wendon	0·84	4	0·26	2·71
Gore	0·78	7	0·35	2·95
Invercargill	1·04	12	0·24	3·60
Puysegur Point	5·82	14	1·20	6·58

—*D. C. Bates, Director.*

INTERIM RETURN OF SHEEP AT 30th APRIL, 1927.

District.	Number of Sheep. Final Return, 1926.	Interim Return, 1927.	Difference.
Auckland	2,244,603	2,271,199	+ 26,596
Gisborne - Hawke's Bay ..	6,236,211	6,271,048	+ 34,837
Wellington - West Coast ..	5,349,436	5,340,603	— 8,833
North Island totals ..	13,830,250	13,882,850	+ 52,600
Marlborough-Nelson-Westland ..	1,353,075	1,345,424	— 7,651
Canterbury-Kaikoura	4,971,322	5,041,489	+ 70,167
Otago	4,750,346	5,102,611	+352,265
South Island totals ..	11,074,743	11,489,524	+414,781
Dominion totals ..	24,904,993	25,372,374	+467,381

Importation of Potatoes.—Regulations under the Orchard and Garden Diseases Act, governing the importation of potatoes into New Zealand, were published in a supplementary *Gazette* dated 5th July, and came into force on that date.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LICE ON SHEEP.

"ANXIOUS TO LEARN," Owaka Valley :—

I should be glad of information regarding lice on sheep and lambs after they have been dipped in paste-dip or other dips, as I cannot get rid of lice at times. Some say that lice are in the paddocks after certain periods of breeding, and come on sheep at different stages of growth. I fail to know where the lice come from, as even tick-eggs are killed by the dip. The lambs are not in poor condition.

The Live-stock Division :—

Non-poisonous dips are useless for lice. In a wet district like Catlins lice breed and thrive better than in a dry one. To keep sheep free from lice a poisonous dip should be used. Good sheep husbandry requires dipping the sheep off the shears with a non-poisonous dip, and again in autumn with a poisonous dip. This suffices to keep sheep clean. Lice-eggs are not killed by the dip. They take from six to ten days to hatch; but if the sheep are thoroughly dipped with a poisonous dip enough remains in the fleece to destroy the young lice when they hatch. Lice cannot live off the body of the sheep for many days. If you wish to be doubly sure that lice are destroyed a second dipping in fourteen days after the first could be done. If sheep are badly infested they will not thrive, but fat sheep can become lice-infested as easily as poor ones.

MANAGEMENT OF PASPALUM-DOMINANT PASTURES.

H. Cox, Rawene, Hokianga :—

I should be obliged if you would advise me whether the burning-off of rank grass in the spring—say, August and September—would have an injurious effect on land which had been top-dressed with basic slag or superphosphate in the preceding autumn. The grass here is mainly paspalum, and there is too much green growth to burn in the autumn. I am now top-dressing with basic slag, and desire to burn all rank growth in the spring.

The Fields Division :—

Occasional burning off of rank paspalum in spring while the ground is still wet does little harm to this grass, which comes away fresh and green again. Continued burning, however, results in a marked delay in the recovery of the paspalum. This has been clearly demonstrated throughout the Hokianga district, where regular burning was practised to provide a fresh bite for the cows in spring. Where pastures have been top-dressed the effect of burning would be less marked, but it must be remembered that so long as paspalum is allowed to get rank enough to burn the clovers will be shaded out, and the result will be a pure paspalum association even with top-dressing. The experience of other farmers in your district is that with top-dressing and a consequent increase in stock, together with adequate subdivision, there is very little rank growth left to burn in spring, even where it is not possible to save hay or use the mower. The pastures that get away in the summer are used for wintering, and the rank growth is cleaned up. This will no doubt be your future experience also, providing you make the best use of the stock available in keeping some of the top-dressed pastures closely grazed during summer, and use the others either for hay or for wintering the stock. By alternately grazing in the summer one season and closing in the next for winter feed, the clovers can be more easily kept going, while the top-dressing can be depended on for the provision of fresh succulent f ⌐ spring without recourse to burning and the loss of the clover in the r .

CATTLE-BREEDING AND GENETICS.

"BREEDER," Piopio :—

I have been breeding Polled Angus cattle for a few years, using pedigree bulls. Together with the Polled Angus cows I have a few well-bred Shorthorns. The progeny from the latter are either pure-black with now and then a little white round the udder, or from light roan to blue-grey. But on breeding from this progeny again (using purebred Polled Angus bulls) there is occasionally a calf with a white leg or legs, or a white star on the forehead. These would not be bred from, but I should like to know how many crosses it would take to entirely eliminate this feature. A crossbred Shorthorn-Hereford still shows a mottled face on the second cross. Is this according to the Mendelian theory—that is, characteristics coming out in the second cross and not in the first?

The Live-stock Division :—

Treating the matter on principles of modern genetics, we do not think that by using your purebred Polled Angus bulls on the progeny of Polled Angus and Shorthorn animals you will ever eliminate the reversion to a recessive colour appearing from time to time. You will probably find that in every four animals produced you will get three black and one that will not be pure-black (ratio 3 1). Black is the dominant colour, and the colours in the Shorthorn would be recessive to black; therefore they crop up only from time to time, and it must take many generations—if it is ever possible—to eliminate them entirely. Your purebred Polled Angus cattle will be what a genetist would term homozygous on both sides—that is, they produce nothing but pure-black stock, as they possess what are called determiners or factors, as well as hereditary characters in the fertilized egg, and these are expressed as development proceeds. The progeny you are breeding from now are what one would term heterozygous as far as coat-colour character is concerned, and from these, even if they are to all appearance pure-black (heterozygous black), there will appear from time to time an animal that shows patches of white. In the same way an occasional red calf crops up in an Angus herd, which can be accounted for if it can be shown that at some time during the formation period in the history of the herd a red individual was employed. In the case of the crossbred Shorthorn-Hereford showing the mottled face on the second cross, this is in accordance with the Mendelian theory.

STOCK SLAUGHTERED, 1926-27.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1927 :—

Stock.	Abattoirs.	Meat-export Slaughterhouses.	Bacon-factories.	Ordinary Slaughterhouses.	Totals.
Cattle ..	157,771	163,268	..	83,946	404,985
Calves ..	42,695	57,791	..	2,472	102,958
Sheep ..	609,581	2,409,396	..	238,409	3,257,386
Lambs ..	126,944	5,343,766	..	23,701	5,494,411
Swine ..	136,544	201,766	41,267	23,143	402,720

—*Live-stock Division.*

Live-stock Statistics.—Interim returns show 3,241,630 total cattle (including dairy cows) in New Zealand at 31st January, 1927, as compared with 3,452,486 (final figures) at the same date in 1926. Dairy cows are returned at 1,295,447 head, as against 1,303,856 in 1926. Pigs show an increase from 472,534 to 516,204, and horses a decrease from 314,867 to 302,088.

The New Zealand
Journal of Agriculture.

VOL. XXXV. WELLINGTON, 20th AUGUST, 1927. No. 2.

TEMPORARY STERILITY IN DAIRY COWS.

INVESTIGATIONS DURING SEASONS 1925–26 AND 1926–27.

W. M. WEBSTER, B.Sc., M.R.C.V.S., Veterinarian, Department of Agriculture, Masterton.

OF recent years dairy-farmers in New Zealand have met with increasing difficulty in getting their cows to hold to service at the desired time. It is becoming a common experience to find numbers of animals, and sometimes even entire herds, which return to the bull time after time, generally at about the normal period of three weeks, but eventually hold towards the autumn. In the following season these animals do not calve until November or December, when the first flush of the milking season is past. Others, again, fail to hold even towards autumn and are milked right through the winter, but almost invariably hold to their first service when put to the bull again in the following November. In either case the net result is a considerable monetary loss to the owner.

In an endeavour to arrive at a definite conclusion as to the causes of this disease, and to evolve, if possible, suitable preventive or curative measures, an extensive study of the whole problem has been undertaken among the dairy herds in the Wairarapa during the past two years.

SCOPE OF THE INQUIRY.

While the result is always the same—namely, a failure to conceive for a longer or shorter period—it was thought possible that there were a number of different factors, any of which, under varying conditions, might be responsible, and in consequence all possible avenues have been explored. Affected herds have been repeatedly visited, and data collected under various headings.

The history of the herd in previous years was obtained. Breed and general conditions were noted, and, whenever available, complete lists of the service dates of each animal were collected. The class of country and the quality of pasture on which affected herds grazed were studied. The method of farming was also taken into consideration, as regards the amount of top-dressing, if any, carried out, whether or not the bull was allowed to run with the herd, &c. Affected animals were thoroughly examined, their condition noted, and various methods of treatment tested. A given number were treated, while others were left as controls in each herd.

The reproductive organs of large numbers of cows going through the freezing-works were systematically examined and the findings tabulated. In this direction the cull-cow "drives" organized throughout the district by the Farmers' Union proved of great assistance. They afforded a large body of suitable material upon which to work, and, in addition, it was possible in many cases to examine individual cows and obtain their histories prior to slaughter, thus comparing ante- and post-mortem findings.

Finally, the possibility that failure to readily conceive was a sequel to some other known diseased condition of the reproductive organs—for example, contagious abortion, pustular vaginitis, &c.—was not lost sight of, and every endeavour was made to discover any existing relationship.

ANATOMICAL RELATIONSHIP, ETC.

Technical terms have been reduced to a minimum, but their total elimination in an article of this nature is impossible. Consequently

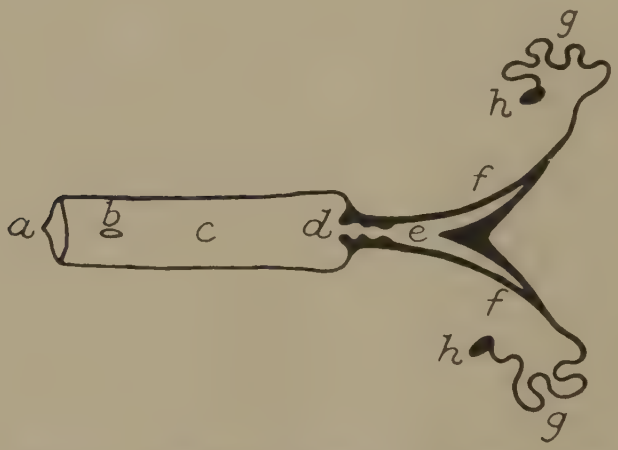

DIAGRAM OF REPRODUCTIVE ORGANS OF COW (FROM ABOVE).

(*a*) Vulva or bearing; (*b*) opening from bladder; (*c*) vagina or passage; (*d*) cervix or neck of womb; (*e*) uterus or womb; (*ff*) horns of uterus; (*gg*) oviducts; (*hh*) ovaries.

it is hoped that the accompanying diagrammatic representation of the reproductive organs of the cow will not only render the majority of such terms intelligible to the reader without further explanation, but also enable him to appreciate the relationship of the various parts of those organs.

POST-MORTEM EXAMINATIONS.

During the past two seasons the reproductive organs of 372 cull cows have been systematically examined at the freezing-works, and notes taken of the findings in every individual. In addition, material was collected, wherever possible, from abnormal cases and forwarded to the Department's Veterinary Laboratory at Wallaceville for further examination.

The animals examined consisted, roughly, of equal numbers of pregnant and empty cows. The great majority of the pregnant animals had been culled for reasons other than temporary sterility, although some had held to service only very late in the season; nevertheless their examination yielded most interesting results.

It would serve no useful purpose in an article such as this to describe the many minor and occasional abnormalities met. The one outstanding feature was the great frequency of cervicitis (inflammation of the cervix or "neck" of the womb). The approximate age of the calf in each cow at the time of slaughter was recorded, and the animals classified under the headings of (*a*) normal pregnancy, (*b*) pregnant with cervicitis.

Table 1.

Total number of pregnant animals, 199.

Date of Examination.	Normal Pregnancy.	Average Duration.	Pregnant with Cervicitis.	Average Duration.
31/5/1926	39	4·8 months	22	2·75 months.
6/4/1927	21	3·1 ,,	5	2·3 ,,
29/4/1927	12	4·1 ,,	15	2·6 ,,
31/5/1927	65	4·5 ,,	20	2·9 ,,

Reference to this table shows a striking difference between the average age of the calf where the mother's cervix is normal and the average age where it is in an inflamed condition (cervicitis). It must also be borne in mind that, no matter what other abnormality was present, an animal was classified as normally pregnant provided it showed no cervicitis.

As the date of slaughter has no bearing on the findings among the empty cows the results of the past two seasons may be considered as a whole. A total of 173 was examined, and, in contrast to the pregnant animals, these were slaughtered without exception for the sole reason that it had proved impossible to get them to hold to service. In tabular form the findings are as follows:—

Table 2.

Number.	Post-mortem Findings.	Percentage of Total.
114	Cervicitis with or without abnormal ovaries ..	65·9
76	Abnormal ovaries with or without cervicitis ..	43·9
56	Cervicitis plus abnormal ovaries	32·4
56	Cervicitis only	32·4
30	Normal	17·3
19	Abnormal ovaries only	10·9

On referring to the table it will be seen that two-thirds of all empty cows were suffering from cervicitis, and that half of these also showed diseased ovaries. On the other hand, only rather more than one-tenth showed diseased ovaries without an attendant cervicitis.

DEDUCTIONS FROM POST-MORTEM RESULTS.

(1) Cervicitis was present in 47·3 per cent. of all animals examined, irrespective of whether or not they were in calf.

(2) Cervicitis is the commonest cause of cows returning repeatedly to the bull. It does not totally inhibit conception, but affected animals have difficulty in holding, and as a rule only do so late in the season and after repeated attempts.

(3) When an animal holds to service despite cervicitis the latter tends to clear up spontaneously between the second and third months of pregnancy. This is shown by Table 1, in which it will be seen that the average duration of normal pregnancy increases approximately *pro rata* with the date of slaughter, whereas among those pregnancies accompanied by cervicitis it tends rather to remain constant.

(4) There appears to be some connection between cervicitis and ovarian disease, but the latter is, as a rule, secondary to the former (compare Table 2). Cervicitis occurred frequently both by itself and associated with abnormal ovaries, whereas the latter only were comparatively rare.

EXPERIMENTAL TREATMENT.

During the 1925-26 season investigation was confined to the post-mortem examinations. The results obtained led to the provisional adoption of the view that cervicitis was the chief cause of temporary sterility. Consequently it was decided to attempt treatment during the past season (1926-27), and, at the same time, confirm the cervicitis theory by further post-mortem work. The latter object was fulfilled, as has been already shown, and the results attending the former will now be dealt with.

In the course of experimental treatment during the past season 243 cows from eleven different herds were examined by means of the speculum. This is a long funnel-shaped instrument which is inserted into the vagina, and by means of which the observer is enabled to obtain a view of the upper part of the vagina and the cervix. The previous history of each cow, including, whenever obtainable, full service dates, was ascertained. Where speculum examination proved negative and in other doubtful cases (seventy-four in all) the uterus and ovaries were examined manually by way of the rectum (the hindmost part of the bowel), through the wall of which they are easily felt. This revealed a number of animals to be in calf (some only recently so) at the time of examination; others had diseased ovaries, septic endometritis (pus in the uterus), &c., which rendered them permanently sterile. This reduced the total to 186 visibly affected with cervicitis and returning to the bull at approximately three-weekly intervals.

In order to gauge accurately the effects of treatment it was necessary to leave a number untreated to serve as controls. Owners were sometimes persuaded with difficulty to adopt this course, but thirty-nine animals were left for this purpose.

Three medicinal agents were given a trial—namely, 10 per cent. Lugol's iodine solution, 2 per cent. iodine in glycerine, and 10 per cent. icthyol in glycerine. The method adopted was to thoroughly swab the inflamed cervix with the selected agent, using a cotton-wool swab on the end of a rod and applied through the speculum. This swabbing was carried out three or four times at four-day intervals, and the condition of the animal noted on each occasion.

For ease in comparison three degrees were recognized—slight, moderate, and severe. At the conclusion of treatment the result was classified under one of four headings—O.K., improved, no change, worse. Frequently cervicitis is accompanied by a varying amount of catarrh of the vagina. Thus a typical case-history would read as follows :—

Service Dates.	First Examination, January 17.	Second Examination, January 21.	Third Examination, January 25.	Fourth Examination, January 29.	Result.
Nov. 14; Dec. 4, 23	Cervicitis severe	Cervicitis moderate	Cervicitis moderate	Cervicitis slight	Improved.
Jan. 13; Feb. 2	Catarrh moderate	Catarrh moderate	Catarrh slight	Catarrh slight.	

Treatment was not an unqualified success. Of the three agents employed, 2 per cent. iodine in glycerine gave the best results, and 10 per cent. Lugol's iodine solution was the least satisfactory; but there was not a great deal between them. The results may be shown statistically thus :—

Table 3.

Result.	Treated Cows.	Controls.
O.K.	36 = 24·6 per cent.	5 = 17·2 per cent.
Improved	44 = 30·1 ,,	6 = 20·7 ,,
No change	47 = 32·1 ,,	16 = 55·1 ,,
Worse	20 = 13·5 ,,	2 = 6·9 ,,
Totals ..	147	29

In one herd ten controls were not examined regularly with the treated cows, and are not included in the above table. Of the treated cows, 54·7 per cent. were either cured or improved, while 37·9 per cent. of the controls either cleared up or improved spontaneously.

Apart, however, from visible signs of improvement is the more important point of holding to service. One hundred and nine treated cows—full service dates of which until 31st March were available—were served altogether 317 times, an average of 2·9 services per cow; while thirty-six control cows took the bull 130 times, an average of 3·6 services per cow, to the same date.

From these figures it is evident that, while treatment has been attended by some small measure of success, a very much higher average of cures must be obtained before it can be said that an

entirely satisfactory method of coping with the disease has been evolved, and it is intended to carry out further experimental work in that direction during the coming season.

Possible Sources of the Trouble examined and discussed.

BACTERIAL ORIGIN.

It frequently happens that temporary sterility suddenly makes its appearance in the majority of a herd which has experienced no trouble in previous years. When a herd is affected there is also a tendency for the trouble to decrease and finally disappear in succeeding years. Again, the disease may be rife in one herd while those adjoining experience no trouble whatever.

These facts lend colour to the view that temporary sterility is a specific contagious disease which appears and runs its course through a herd. In an endeavour to substantiate this theory a large amount of material has been obtained, not only from affected organs from the freezing-works but also from the inflamed cervix in the living cow, and submitted to examination at the Wallaceville Laboratory. Hitherto no success has been attained in this direction; much of the material has proved to be absolutely sterile, while from other samples only various of the commoner bacteria, which may be found in many situations, have been isolated.

There is, of course, the possibility that the disease is due to what is known as a virus—that is, an infective organism which is so small that it passes through the finest bacteriological filter and is invisible under the most powerful microscope. However, in view of the apparent contagion in many instances, it is intended to continue the search for a possible causative organism next season.

THE BULL.

The possible bearing which the bull has upon this disease is a big problem, and, in many ways, one of the most difficult with which to deal. He does not admit of any close examination unless roped and thrown. The reproductive organs of twenty-three bulls were examined in connection with the cull-cow drives, but no abnormalities were discovered. A very limited amount of bacteriological work in the same direction also proved abortive.

Up to the present it has not been possible to prove that the bull does carry the infection from cow to cow, although there are some indications in that direction; on the other hand, cervicitis has been found in young heifers, and even in a calf six months old. However, there exists a strong possibility that the bull may play some such part, and irrigating the bull's sheath after every service is an ideal to be strongly impressed upon dairy-farmers. Past experience has shown that repeated douching has had little or no effect upon the cows; indeed, there is a suspicion that in some cases an excess of zeal in the matter of such douching has been productive of harm rather than good through setting up an irritable condition of the vagina.

The act of calving and cleansing afterwards is a perfectly natural physiological process at full time. Provided the cleansing comes away within five or six hours of calving and there is no abnormal discharge afterwards, there should be no necessity to douche the cow. In the case of abortion, a dead calf, retained membranes, or undue purulent discharge, disease is present, and suitable antiseptic douching

is then indicated. As already stated, even repeated douching has hitherto failed to effect a cure in affected cows, while no sign of disease has hitherto been disclosed in the bull. The male may thus be a mechanical carrier of the disease from cow to cow, in which case irrigation of the sheath after every service should go a long way towards limiting the extent of the trouble.

The bull should always be kept in a separate paddock, and cows be put to him as required; the practice of running the bull with the herd cannot be too strongly condemned. He is, as a rule, easily broken in to show little or no resentment to the irrigation. The writer has seen bulls which could be irrigated standing in the paddock. It is, however, important never to use any antiseptic solution which may cause smarting or burning, especially when first breaking the animal into the treatment. A weak solution of permanganate of potash (Condy's crystals) of port-wine colour is sufficient for the purpose.

CONTAGIOUS ABORTION.

Contagious abortion was thought to be a factor in causing temporary sterility, but, up to the present, investigation has failed to establish any connection between the two. Contagious abortion in some instances certainly does bring about a state of sterility, but it is of a permanent and not a temporary nature. The act of abortion is frequently followed by retention of the membranes, which are firmly adherent and have often to be left to gradually rot away. This sets up what is known as septic endometritis, in which small quantities of thick, clotted, fœtid pus remain in the uterus for a long period extending sometimes over several years. This naturally precludes any possibility of the animal holding to service.

In the course of the post-mortem examinations recorded earlier endometritis was met with in only nine cases, six of which were associated with cervicitis and/or ovarian disease. Furthermore, as shown by individual histories which have been obtained, such cases are characterized by the extreme irregularity and short intervals at which the cow returns to the bull. Cows in herds under observation, in which contagious abortion was rife in the spring, had no difficulty in getting in calf again, save in odd instances such as described above. In addition it is possible by a simple laboratory test to determine whether any animal has been affected with contagious abortion, but examination at the Laboratory of numerous blood-samples taken from cows suffering from temporary sterility has failed to show any connection between the two diseases.

Granular Vaginitis.

This comparatively harmless condition was formerly viewed with suspicion, but all attempts to implicate it have proved negative. Probably over 50 per cent. of all cows are affected, and it is found equally in virgin heifers and aged cows. Further, routine examination has shown that very frequently the animals returning repeatedly to the bull show little or no sign of the complaint, while the worst-affected animals in the same herd have held successfully to the first service. In other instances the great majority of a herd the members of which have experienced no difficulty whatever in getting in calf are found affected.

Pustular Vaginitis.

This is a form of venereal disease in which the symptoms are extremely rapid in onset. Within twelve to twenty-four hours from the time of service affected animals show marked discomfort, standing blaring with arched back and distended tail. Urine is repeatedly passed in small quantities, and there is a purulent yellow discharge from the vulva. On examination the lining membrane of the vagina is seen to be intensely inflamed, and thickly studded with small white pustules and ulcers. The ulceration tends to spread, and may be so extensive that the greater part of the membrane is destroyed. In one herd, thirty-eight in number, under observation, eighteen animals went to the bull and were affected as described within twenty-four hours of service. Strict isolation of the affected animals and the use of a clean bull on the remaining twenty completely arrested the spread of the disease. Fifteen of the affected animals held to their service; the remaining three returned, but had not cleaned up at the time; however, they held successfully when put to the bull six weeks later. Under treatment the symptoms cleared up in about three weeks. A noteworthy point was that, although the whole of the vagina was acutely inflamed, the cervix remained clean and healthy-looking throughout.

Mineral Deficiency.

The possible bearing of this factor was borne in mind and extensively investigated. The condition known as "Waihi disease" occurs in several localities in the Wairarapa district, on poor land among the foothills of the ranges which is unsuited for dairying. It is characterized by general poverty, a sunken eye, harsh coat, chewing of bones and sticks, and rheumatism in the joints. Affected animals frequently feed kneeling and move with great stiffness, accompanied by audible clicking and creaking of the joints. Rapid improvement results from the provision of a suitable mineral lick or from feeding a little bran with the addition of bone-meal, superphosphate, &c., in suitable quantities. Five herds thus affected have been under observation. The worst, forty-five in number, was almost generally affected to such an extent that it took three-quarters of an hour morning and evening to drive the animals from bails to paddock, a distance of half a mile.

Another characteristic of this condition is a complete failure of some cows to come to season, yet every animal held successfully to the first service, though some of them did not come on for the first time until late in the season and in response to mineral feeding. In only one herd were there some six or eight cases of regular return to the bull showing typical cervicitis, in addition to a number of others which never came to season and in which the cervix was normal.

On the other hand, the majority of the worst-affected herds were grazing on first-class land, and were in two instances in fat condition. One herd, thirty-seven in number, all of which were still returning to the bull at the end of January, and eleven still empty at the end of the season, was without exception in fat condition, grazing on a first-class farm which had been systematically top-dressed for several years. Another large herd of 134, grazing on drained swamp which has never

been top-dressed, has forty cows still empty at the end of the season. Further similar instances could be quoted, but the foregoing seem to show that the available supply of phosphorus has little or no bearing on temporary sterility of the type described in the opening paragraph of this article. Investigators elsewhere have shown that a lack of sufficient available calcium or potassium in the ration has a direct bearing on reproduction.

There is another aspect of mineral deficiency in the soil which also remains open to investigation. It is a well-known fact that New Zealand soil as a whole is markedly deficient in iodine compared with most parts of the world. Recent research work, which is still proceeding, in parts of Canada and other countries where a similar iodine deficiency exists, has demonstrated that feeding minute daily doses of iodine has brought about not only a general bodily improvement of stock but also an increased breeding fertility. In view of these results there is a possibility that the addition of either or all of these minerals to the ration may be attended by beneficial results in this country, and experiments in this direction will be initiated during the coming season.

Acidity.

It has been recognized for a number of years that a very slight degree of acidity rapidly destroys the vitality of the spermatozoa (the living elements in the male fluid). The upper part of the vagina and cervix is normally slightly alkaline in reaction, but occasionally a slight degree of acidity is present. To neutralize this condition where it exists, douching with a solution of bicarbonate of potash a short time prior to service is practised with good results. In order to ascertain the frequency with which acidity occurs tests were made in some 150 cows. Only three gave an acid reaction, while seven were neutral; the remainder were normal—that is, slightly alkaline. In view of this, acidity may be dismissed as a minor factor in the problem.

CONCLUSION.

Much further work requires to be done before the problem of temporary sterility is satisfactorily solved, but the investigations up to the present seem to have considerably narrowed the scope of inquiry and given a clearer understanding of the problem. A number of factors formerly regarded with suspicion as having a possible bearing on the subject have been eliminated, and attempts at treatment have met with some slight measure of success, seemingly indicating at least that work is proceeding on the correct lines. Efforts towards the end in view will be continued during the coming season, including mineral feeding and a trial of other medicinal remedies, and it is confidently anticipated that a solution of the problem will eventually be reached.

The writer desires to express his thanks to Messrs. C. S. M. Hopkirk, B.V.Sc., and D. A. Gill, M.R.C.V.S., D.V.S.M., of the Wallaceville Veterinary Laboratory, who carried out all the detailed microscopic and bacteriological examination of pathological material, involving, as it did, a large amount of protracted and careful work. He is also indebted to Mr. J. Watson, Provincial Secretary of the Farmers' Union, for information concerning the various cull-cow drives.

NEW ZEALAND DAIRY-FARMING ECONOMICS.

SURVEY OF FARM GROUP IN PIAKO COUNTY, SEASON 1926–27.

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The Fields Division of the Department of Agriculture has for some time past been engaged on an economic survey of the New Zealand dairying industry. The following article summarizing recent work on a group of thirty-five farms in Piako County is now presented, not for the purpose of drawing definite conclusions—since the number of farms dealt with is too small—but rather as an indication of the nature of the work and to show the necessity of its extension, so that the many variants enumerated may be "flattened out," with the object of giving a true picture of average dairy-farming conditions.

PIAKO COUNTY.

Taking the official statistics for 1926, Piako County has a total area of 229,138 acres of occupied land, of which 194,102 acres are improved. Comprised in the latter class are 165,985 acres of sown pastures used exclusively for grazing, while some 22,000 acres are cut for hay or ensilage, or used for root or forage crops. Stock includes 53,741 dairy cows (23·454 per 100 acres), 44,475 sheep (19·410 per 100 acres), 33,195 other cattle (14·486 per 100 acres), and 5,058 horses (2·207 per 100 acres). In addition, there are 18,000 pigs—approximately 8 per 100 acres.

The county lies in an easterly direction from Hamilton, and is served by the Auckland Thames Railway. The chief town is Te Aroha, twenty-nine miles by rail from Hamilton.

Rainfall distribution is particularly favourable for pasture-maintenance, and to this factor the district largely owes its success in dairying. The rainfall for the year ended 30th June, 1927, was as follows:—

		Fall in Inches.	Number of Wet Days.
1926	July	5·94	8
	August	6·92	19
	September	2·79	12
	October	8·63	23
	November	6·20	23
	December	5·66	11
1927	January	1·01	8
	February	5·86	10
	March	5·00	17
	April	2·15	13
	May	5·39	15
	June	3·52	13
	Totals	59·07	172

The particular locality to which this summary pertains is situated on the bank of the Waihou River, the largest number of farms being on the edge of the swamp area.

Table 1.—Production and Costs per 100 Acres.

1.	2.	3.	4.	5.				6.	7.					8.	9.	10.	11.	12.	13.	14.
				Returns from					Expenses.											
Sub-group Number.	Total Butterfat produced.	Number of Cows milked.	Production per Cow.	Butterfat at 1s. 4d. per lb.	Pigs Account.	Cattle Account.	Total.	Fertilizer used for Top-dressing.	Manure.	Repairs.	Sundry.	Power, Testing, and Rates.	Total.	Maintenance Cost per Pound of Butterfat.	Interest, Labour, and Profit Capacity.	Capital Value (Land, Buildings, Stock, and Equipment).	Interest on No. 10 at 6% + 1% Sinking Fund.	Labour at £7 per Cow.	Profit.	Cost per Pound Butterfat-production.
	lb.		lb.	£	£	£	£	Tons.	£	£	£	£	£	d.	£	£	£	£	£	d.
1	17,035	57	317	1,196	16	56	1,272*	15·7	97	10	108	89	304	4·079	968	4,129	289	399	280	13·3
2	15,443	51	309	1,029	95	−6	1,147*	17·4	111	15	91	85	302	4·697	845	3,626	254	357	234	14·2
3	12,880	41	313	859	70	44	973	11·8	76	24	56	68	225	4·169	748	3,474	243	287	218	14·1
4	11,691	41	289	779	46	57	882	11·0	76	20	48	65	209	4·281	673	3,254	228	287	158	14·8
5	10,504	35	307	701	54	23	778	12·2	81	6	50	42	182	4·110	596	3,187	223	245	128	14·9
6	9,479	38	250	632	41	46	719	10·4	70	17	32	60	179	5·665	540	2,950	207	266	67	16·5
7	7,612	29	259	507	30	39	576	10·8	69	10	27	42	148	4·678	428	2,225	158	203	67	16·1
General average	12,220	42	291	815	50	42	907	12·7	83	15	59	64	221	4·364	685	3,264	230	294	162	14·6

* Owing to cattle losses in subgroups 1 and 2, the returns from butterfat, pigs, and cattle do not add up to the respective totals shown.

(See next page.)

METHOD OF COLLECTING DATA.

The "survey" method was used—that is, each farmer was visited personally by a responsible officer, information being entered on a farm-survey form. Wherever possible, figures were checked from authentic records. So far as dairy farms are concerned, the winter months of June and July are most suitable for this work, as the season has just ended and data is therefore more likely to be correctly supplied than is the case at a later date.

AREA OF FARMS AND GENERAL DESCRIPTION.

The area of the farms in the group varies from 50 to 300 acres, the larger farms generally being situated on lighter country. The group is confined within a radius of approximately six miles. Area has a decided effect on production per acre, as indicated by Table 3.

Sixteen of the farms supply butter-factories, fourteen cheese-factories, and five dried-milk factories; share milkers are employed on nine of the farms; on six milking is done entirely by hand. The present owners have occupied thirteen of the farms for a period of less than nine years.

On the whole, pastures are in excellent condition Approximately 50 per cent. of the farms provide winter feed in the form of swedes, such farms benefiting also from young grass sown after the root crop. Hay is saved in practically every case, the average area cut being approximately 14 acres. Several of the farms are too large for economic production, and in some cases paddocks need subdividing to allow stock-rotation on to fresh pasture growth. None of the farms is really overstocked.

Herds are maintained from picked calves, buying-in of cows being very rare.

PRODUCTION AND EXPENSES PER 100 ACRES.

For purposes of comparison all figures have been compensated to a 100-acre unit. It is not intended at this stage to discuss farms individually, but rather to show the averages for subgroups of farms, and then give a running commentary on the factors affecting them. Table 1 (see preceding page) shows the averages for subgroups of five farms each, classified from the highest to the lowest per-acre producers. The general average applies to the whole thirty-five farms.

PRODUCTION PER ACRE.

Up to a certain point the per-acre production is the most important economic factor in New Zealand dairy-farming. To what extent this figure can be raised without undue operation of the law of diminishing returns we do not at present know. The safe figure is apparently considerably above that reached by any farm within the group. The range of production is from 59·58 lb. to 206·47 lb. of butterfat per acre, with an average of 122·20 lb. The "frequency" of farms is more uniform below than above the average.

Table 2.—Distribution of Farms round the Average.

%	%		lb.	lb.		
61 to 70	above average equals		195·52 to	207·74	.. 1	farm.
51 ,, 60	,,		183·30 ,,	195·52	.. 1	,,
41 ,, 50	,,		171·08 ,,	183·30	.. 0	,,
31 ,, 40	,,		158·86 ,,	171·08	.. 6	,,
21 ,, 30	,,		146·64 ,,	158·86	.. 1	,,
11 ,, 20	,,		134·42 ,,	146·64	.. 1	,,
0 ,, 10	,,		122·20 ,,	134·42	.. 5	,,
0 ,, 10	below average equals		122·20 ,,	109·98	.. 5	,,
11 ,, 20	,,		109·98 ,,	97·76	.. 5	,,
21 ,, 30	,,		97·76 ,,	85·54	.. 7	,,
31 ,, 40	,,		85·54 ,,	73·32	.. 0	,,
41 ,, 50	,,		73·32 ,,	61·10	.. 2	,,
51 ,, 60	,,		61·10 ,,	48·88	.. 1	,,

It is quite apparent that the factor of area of the farms has a decided influence on per-acre production. The study of even a small number illustrates this fact, as shown in the following table :—

Table 3.—Butterfat-production per Acre relative to Size of Farm.

Area.	Number of Farms.	Cows milked per 100 Acres.	Butterfat produced per Acre.
Acres.			lb.
50 to 80	6	50	139·29
81 ,, 100	7	40	127·90
101 ,, 200	15	42	123·44
201 and over	7	35	99·18

This table also indicates the relatively higher carrying-capacity of smaller areas intensively farmed.

BUTTERFAT AVERAGE PER COW.

Production per cow is closely connected with per-acre production. With the exception of four herds, the first fifteen farms have an average of over 300 lb. per cow. The production figures have been determined on carrying-capacity rather than on herd-testing figures—that is, total production has been divided by the number of cows at the beginning of the season, irrespective of those thrown out after a few weeks' lactation. The average figure for the thirty-five farms corresponds with the factory average over the whole locality. The average per cow equals 291 lb. for the season.

Table 4.—"Spread" of Herd Averages.

%	%		lb.	lb.		
31 to 40	above average equals		378 to	407	.. 1	farm.
21 ,, 30	,,		349 ,,	378	.. 3	,,
11 ,, 20	,,		320 ,,	349	.. 2	,,
0 ,, 10	,,		291 ,,	320	.. 10	,,
0 ,, 10	below average equals		291 ,,	261	.. 11	,,
11 ,, 20	,,		261 ,,	232	.. 5	,,
21 ,, 30	,,		232 ,,	203	.. 3	,,

PIG ACCOUNT.

On nine of the farms pigs are not kept. Most of the pigs are sold as weaners. The average return from this source is low, being

approximately £1 3s. 11d. per cow over all the farms. The highest return of any individual farm is £3 17s. per cow. There are 118 sows on the thirty-five farms, or one sow per eighteen cows. Each sow reared 10·5 pigs for the season. The death-rate among pigs in this district appears to be approximately 25 per cent.

CATTLE ACCOUNT.

As previously stated, the herds in this district are chiefly maintained from home-reared heifers. The average cow-replacement is approximately 17 per cent. on the farms under consideration. It is generally argued that, owing to this high annual renewal, depreciation should show as an expense in the accounts of a dairy-farmer. If all replacements were made by purchase of springing heifers or cows a loss would undoubtedly result, as cows must be charged in the account at a standard value. But where calves are reared, and eventually go into the milking-herd, an appreciating value must be put on them until they are absorbed. The Cattle Account will generally show a profit unless ill fortune has been experienced. The alternative method is to run two accounts—one for the milking-herd proper, and one which might be termed "Cattle-breeding Account." In this case the first account might show a loss, but the latter would show a profit.

All cattle on each farm have been incorporated in the one account. Standard values of £10 per cow, £5 per yearling, and £20 per bull have been used throughout. On six farms the Cattle Account showed a loss, but the average profit was £42 per 100 acres, or £1 per cow. When losses are made the amount is included in sundry expenses and considered as an incidence in the cost of production.

GROSS RETURNS.

In computing the gross returns from farms the value of butterfat had to be estimated, as bonus payments have not yet been made. The figure used is 1s. 4d. per pound, which, in the opinion of competent authority, is likely to be very near the final figure realized for the season of 1926-27. Gross returns per acre are influenced considerably by the Pig and Cattle Accounts. The average is £9·07, or £21·57 per cow.

Table 5—"Spread" of Gross Per-acre Earning-capacity of Farms.

%	%		£	£			
51	to 60	above average equals	13·60	to 14·50	..	1	farm.
41	,, 50	,,	12·69	,, 13·60	..	1	,,
31	,, 40	,,	11·79	,, 12·69	..	5	,,
21	,, 30	,,	10·88	,, 11·79	..	2	,,
11	,, 20	,,	9·97	,, 10·88	..	2	,,
0	,, 10	,,	9·07	,, 9·97	..	4	,,
0	,, 10	below average equals	9·07	,, 8·16	..	7	,,
11	,, 20	,,	8·16	,, 7·25	..	5	,,
21	,, 30	,,	7·25	,, 6·34	..	5	,,
31	,, 40	,,	6·34	,, 5·44	..	2	,,
41	,, 50	,,	5·44	,, 4·53	..	0	,,
51	,, 60	,,	4·53	,, 3·62	..	1	,,

FERTILIZERS FOR TOP-DRESSING.

It is being generally appreciated by dairy-farmers that high per-acre production depends finally on grass-renovation. High-producing strains of cows are very important, but a high-producing cow quickly becomes a low producer if not adequately nourished. It is at the present time more profitable to renovate grass pastures by the liberal use of phosphatic fertilizers than by the use of the plough, though the plough may in the first instance be necessary to procure the foundation on which to work.

In this group of farms twelve top-dress 100 per cent. of their land, and the average is 89 per cent., with fertilizers amounting to 12·7 tons per 100 acres. The smaller farms are manured more heavily than are the larger. The data at present to hand are not sufficient to permit of a definite comparison of effect of heavy top-dressing, but this will be made at a later date.

Table 6.—"Spread" of Manure used, in Tons per 100 Acres.

%	%		Tons.	Tons.		
61 to 70	above average equals		20·32 to	21·49	3	farms.
51 ,, 60	,,		19·05 ,,	20·32	1	,,
41 ,, 50	,,		17·77 ,,	19·05	1	,,
31 ,, 40	,,		16·78 ,,	17·77	0	,,
21 ,, 30	,,		15·24 ,,	16·78	5	,,
11 ,, 20	,,		13·97 ,,	15·24	3	,,
0 ,, 10	,,		12·70 ,,	13·97	3	,,
0 ,, 10	below average equals		12·70 ,,	11·43	2	,,
11 ,, 20	,,		11·43 ,,	10·16	7	,,
21 ,, 30	,,		10·16 ,,	8·89	4	,,
31 ,, 40	,,		8·89 ,,	7·62	2	,,
41 ,, 50	,,		7·62 ,,	6·35	3	,,
51 ,, 60	,,		6·35 ,,	5·08	1	,,

MAINTENANCE COSTS.

Maintenance includes all expenditure other than for labour, interest, or land-tax. It is here that great variation is found, resulting in a wide range of production costs. Depreciation on plant and buildings at the rate of 5 per cent. and 3 per cent. respectively is included. Herd-testing and electric power are included at standard rates on those farms concerned. The average maintenance cost per acre is £2·21, or £5 5s. 3d. per cow.

Table 7.—Showing "Spread" of Maintenance Costs per Acre.

%	%		£	£		
71 to 80	above average equals		3·75 to	3·97	1	farm.
61 ,, 70	,,		3·53 ,,	3·75	1	,,
51 ,, 60	,,		3·31 ,,	3·53	1	,,
41 ,, 50	,,		3·09 ,,	3·31	2	,,
31 ,, 40	,,		2·87 ,,	3·09	1	,,
21 ,, 30	,,		2·65 ,,	2·87	1	,,
11 ,, 20	,,		2·43 ,,	2·65	7	,,
0 ,, 10	,,		2·21 ,,	2·43	3	,,
0 ,, 10	below average equals		2·21 ,,	1·98	3	,,
11 ,, 20	,,		1·98 ,,	1·76	6	,,
21 ,, 30	,,		1·76 ,,	1·54	2	,,
31 ,, 40	,,		1·54 ,,	1·32	3	,,
41 ,, 50	,,		1·32 ,,	1·10	1	,,
51 ,, 60	,,		1·10 ,,	0·88	1	,,
61 ,, 70	,,		0·88 ,,	0·66	2	

Although the range as shown in the table is wide, it varies very much in accordance with per-acre production. From a study of Table 1 it will be seen that the group averages of five farms give a fairly consistent maintenance cost per pound. Expenses increase with a higher per-acre production, but increased production more than compensates for such an advance. With more data it is hoped that standards of maintenance costs will be established for different classes of farms, so that there may be available "efficiency standards" against which to check any farm coming under review.

INTEREST AND LABOUR CAPACITY.

The value of land depends upon its capacity, after maintenance expenses are met, for the earning of interest and the reward of labour, whether interest be payable on borrowed money or on personal capital, and whether labour be paid or be that of the owner. It will be noticed that the average amount left for these purposes is £685 per 100 acres, and that it decreases from £968 on the five highest farms to £428 on the five lowest.

The capital value of the land (Government valuation) is lower on the lower-producing farms, and therefore the total interest is less. So also is the value of plant, machinery, and stock. The fact that these poorer farms carry less cows per 100 acres means a lower labour bill for milking, but increased labour on maintenance. Despite these factors the final cost of production is less on the high-production farms.

From this stage consideration of the figures presents difficulties. On some farms no wages are paid; others pay nominal wages, most of the work being done by the owner; while others, again, employ share milkers who take one-third of the gross proceeds in lieu of wages. The same difficulty arises with regard to interest paid on mortgages. A proportion of the farms are unencumbered or practically so.

In order to overcome these irregularities it became necessary to standardize interest and labour. The capital value has therefore been taken, and to this is added the value of stock and equipment, charging the whole at the rate of 6 per cent. plus 1 per cent. sinking fund. It is recognized that this is not in every case the true value of the farm, but in the absence of a Land and Improvements Account it is the most uniform basis on which to work. Subgroups will be seen to vary from £4,129 to £2,225, with a general average of £3,264, of which £758 is stock and equipment. At 7 per cent. this represents an average annual interest cost of £229, or £5 9s. per cow.

After deducting interest from the amount representing interest and labour the remainder can, if it is wished, be considered as the labour earning capacity of the farm, but this would give an entirely wrong impression when interpreted in cost of production of butterfat. It has therefore been decided to charge all cows with £7 for wages. Thus if one man milks twenty-five cows his herd is charged with £175 for labour. This is purely an arbitrary assessment, but corresponds very closely with the per cow earnings of share milkers.

Table 9.—Showing Variat

(Figures pertaining to No. 3 Farm print

1.	2.	3.	4.	5.	6.	7.	8.	9.
Total Butterfat.	Number of Cows milked.	Butterfat per Cow.	Butterfat at 1s. 4d. per Pound.	Returns from Pigs.	Cattle Account.	Total Returns.	Manure.	
							Quantity.	Area top-dressed.
lb.		lb.	£	£	£	£	Tons.	Acres.
..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	100
..	..	..	..	..	..	..	..	100
..	..	..	..	..	..	..	..	100
..	..	..	..	..	**162**	..	..	100
..	..	400	..	200	104	..	21·5	100
20,647	63	375	1,376	150	91	1,412	21·3	100
19,500	62	366	1,300	114	89	1,300	21·0	100
16,600	61	350	**1,107**	112	86	**1,269**	20·2	100
16,476	60	345	1,098	103	84	1,256	18·4	100
16,452	**54**	338	1,097	102	63	1,255	16·3	100
16,143	52	320	1,076	98	63	1,189	16·0	100
16,130	51	319	1,070	90	57	1,188	15·4	**100**
16,000	47	317	1,067	81	57	1,133	15·3	99
14,831	46	312	989	81	55	1,125	15·3	98
14,111	45	310	941	72	55	1,077	**15·0**	98
13,408	45	**307**	894	69	54	1,025	14·6	94
12,933	44	305	862	69	46	987	14·1	93
12,829	44	305	855	66	45	947	13·8	93
12,768	44	300	851	55	44	935	13·1	93
12,461	43	295	831	53	43	918	13·1	92
Average 12,220	42	291	815	50	42	907	12·7	89
12,150	41	288	810	43	36	901	12·5	87
11,790	40	285	786	39	34	889	12·4	86
11,714	40	282	781	33	34	862	11·4	86
11,600	40	281	773	28	31	855	11·3	83
11,200	38	279	747	26	23	848	10·9	81
10,946	38	279	730	22	19	837	10·9	80
10,809	38	268	721	18	15	831	10·8	80
10,345	37	267	690	17	14	777	10·5	79
10,313	37	266	688	10	13	756	10·3	79
10,105	36	264	674	8	5	747	10·0	78
9,751	36	264	650	**Nil**	4	744	10·0	73
9,536	35	258	636	Nil	—7	729	9·6	63
9,500	34	258	633	Nil	—12	724	9·4	60
9,375	31	255	625	Nil	—17	703	8·0	40
9,231	30	249	616	Nil	—23	664	7·9	..
9,130	30	247	609	Nil	—24	641	6 7	..
9,099	27	227	607	Nil	—104	638	6·5	..
7,055	27	221	470	Nil	..	578	6·4	..
6,818	25	217	455	Nil	..	554	6·0	..
5,958	..	..	397	..	..	444	..	..
..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..

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Acres in each Factor.

tem of indicating individual farms.)

13	14.	15.	16.	17.	18.	19.	20.
Power, esting, d Rates.	Total of Columns 10 to 13.	Wages, Interest, and Profit.	Government Value of Land + Stock and Plant.	Interest on Capital Value at 6% + 1% Sinking Fund.	Wages at £7 per Cow.	Profit.	Cost of producing Butterfat per Pound.
£	£	£	£	£	£	£	d.
112	..	..	..	..	..	..	..
92	..	..	..	..	..	..	..
91	..	..	..	..	..	..	19·0
90	..	..	..	..	..	453	18·3
89	385	1,044	4,758	333	..	395	18·0
89	360	1,027	**4,670**	**327**	..	391	17·3
88	**336**	994	4,450	312	441	339	16·4
86	328	993	4,423	310	434	310	16·4
81	319	**933**	4,212	295	427	294	16·4
80	302	886	4,192	294	420	277	16·1
80	281	844	4,145	290	**378**	264	16·1
74	262	829	4,105	287	364	263	16·0
73	262	814	4,014	281	357	248	16·0
71	262	785	3,740	262	329	**228**	15·4
71	261	769	3,683	258	322	220	15·4
70	256	752	3,653	256	315	216	15·1
69	256	749	3,500	245	315	187	15·1
67	247	748	3,481	244	308	182	15·0
66	242	714	3,432	240	308	179	15·0
65	239	707	3,430	240	308	174	**15·0**
65	228	704	3,353	235	301	174	14·6
64	221	685	3,264	230	294	162	14·6
60	220	674	3,250	228	287	146	14·6
60	211	667	3,096	217	280	145	14·2
55	208	657	3,052	214	280	126	14·0
53	195	644	2,988	209	280	107	14·0
48	193	643	2,965	208	266	84	13·6
47	188	642	2,935	205	266	77	13·1
45	188	620	2,879	202	266	68	12·4
43	187	521	2,857	200	259	59	12·4
40	182	508	2,684	188	259	57	12·4
37	164	505	2,625	184	252	45	12·4
33	161	503	2,573	180	252	35	12·2
28	150	497	2,559	179	245	28	11·5
20	138	494	2,552	179	238	27	11·4
17	133	492	2,300	171	217	6	11·4
..	130	477	2,220	155	210	−2	11·0
..	103	440	2,050	144	210	−31	..
..	85	361	1,824	129	189	−76	..
..	80	359	1,572	111	189	..	..
..	..	..	..	..	175	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..

PROFIT.

After deducting interest at 7 per cent. and wages at £7 per cow from the interest and labour earning-capacity of the thirty-five farms, a surplus is in most cases left, which varies from £280 per 100 acres on the highest group to £64 on the lowest, with a uniform drop throughout.

The returns indicated in the Cattle Account are not all handled as cash.

COST OF PRODUCTION.

If these figures are considered as relatively correct, it is then possible to compute the cost of producing 1 lb. of butterfat. The average cost for subgroups varies from 13·3d. to 16·5d., with a general average of 14·6d. per pound.

Table 8.—"Spread" of Production Costs per Pound of Butterfat.

%	%		d.	d.		
31 to 40	above average equals		18·98 to	20·44	..	1 farm.
21 ,, 30	,,		17·52 ,,	18·98	..	3 ,,
11 ,, 20	,,		16·06 ,,	17·52	..	6 ,,
0 ,, 10	,,		14·60 ,,	16·06	..	11 ,,
0 ,, 10	below average equals		14·60 ,,	13·14	..	4 ,,
11 ,, 20	,,		13·14 ,,	11·68	..	8 ,,
21 ,, 30	,,		11·68 ,,	10·22	..	2 ,,

GENERAL.

It is admitted that the figures submitted may be inaccurate in certain details. In the original collection of data it is very easy for a farmer to forget certain items or to overestimate others, and the number of farms dealt with are not sufficient to equalize matters. The summary, however, is an attempt to show the true position as it pertains to these farms.

Apart from such original shortcomings, other items which might be questioned are (*a*) value of butterfat, (*b*) Cattle Account, (*c*) capital valuation, (*d*) rate of interest, and (*e*) labour charges.

As the figures stand, the final balance of £162 is accounted for mainly by the Pig and Cattle Account. A percentage of the profit shown in the latter is, of course, never handled in the form of cash. If pigs are regarded as a by-product of the dairy industry their importance in the final issue is very great. In this survey they represent 30·9 per cent. of the profit; Cattle Account, 25·9 per cent.; and butterfat, 43·2 per cent.—butterfat having borne all costs of production.

These farms show, on the whole, a very satisfactory position, but it must be remembered that their production is considerably above the average. A drop of 24 lb. per acre would put the group in an uneconomic position.

THE INSTRUCTIONAL ASPECT.

It is hoped that results of these group investigations may have a direct instructional value for the farmers concerned, in addition to providing data on which departmental instruction may be founded.

To this end each farmer who has supplied information will, when the group of which he is a member has been analysed, be supplied with a chart as depicted in Table 9. It will be noticed that the general average for all items in this table occupies the central line, with figures relative to each factor arranged from highest to lowest across the general average. On the chart to be supplied individual farmers the figures in each column pertaining to their own farms will be underlined. A specimen is indicated by heavy type in the printed table. The identity of the other farmers is completely hidden owing to a standard area being used, and also owing to the fact that in no case do the particulars of any farm run straight across the sheet. Each farmer will therefore be able to compare his own position with the remainder of the group and with the average of the whole thirty-five farms. If he is at all interested it will rest with himself to decide if he can in any way improve his position. A key to each chart will be kept in the Wellington office in case of correspondence on any point.

It is hoped that eventually farm types will subject themselves to a classification system. Standards will then be set up for each group, which will act as guides and comparisons for farmers, prospective farmers, and agricultural instructors generally. The first essential in such a task is possession of the survey data from a large number of farms, so that types may be picked out and placed in their respective groups.

CONCLUSION.

As previously stated, the present data are published as an indication of the work being done by the Department of Agriculture, in the hope that this will influence farmers generally to co-operate in the supply of information. It will have been demonstrated that the individual is entirely hidden, and thus result in greater confidence. It is expected to have data from some 150 Waikato farmers within the next few weeks, when further detailed tabulations will be made.

No attempt has been made to assess the rental value of the farmer's dwellinghouse, but it should be recognized that the house and farm perquisites are real assets, and must eventually be dealt with if a true statement of the position is to be made.

I wish at this stage to express my appreciation of the manner in which Mr. C. M. Hume, of Hamilton, has co-operated with the Department in this work. His advice and knowledge of the district have been freely given at all times. Thanks are also especially due to those farmers who have supplied the data making this survey possible. The field-work in connection with the group was done by Mr. I. W. Weston, M.Sc., of the Department of Agriculture

Average Weights of Lamb and Mutton.—According to the Meat Board, the average dressed weights at the meat-export works for the freezing season of 1926-27 were as follows (corresponding figures for 1925-26 being added in parentheses): Lambs, 34·8 lb. (34·3); wethers, 55·9 lb. (54·6); ewes, 54·6 lb. (54·1).

MANURIAL TOP-DRESSING OF HILL GRASSLAND IN MARLBOROUGH.

SOME RECENT EXPERIMENTAL WORK.

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HILL top-dressing experiments have now been in progress in the Marlborough District for two years. Work has been carried out on three distinct types of country.

(1) The hill country of the Upper Wairau Valley, at Hillersden and at Wantwood: This country, although comparatively poor, is clean, owing to the relatively dry climate and mainly sunny aspect. The vegetation varies as the altitude increases. At Hillersden and Wantwood, where the flat land is about 1,000 ft. above sea-level and the hill land from 1,500 ft. to 1,760 ft., the country is covered mainly by Danthonia pilosa, brown-top (*Agrostis tenuis*), hair-grass (*Aira flexuosa*), Yorkshire fog in the gullies, and brown-tussock. Bracken fern and manuka appear on the shadier and damper faces, but are easily cleared and kept under control. As one goes farther up the valley the proportion of tussock increases, native wheat (*Triticum scabrum*) and New Zealand rice-grass (*Microloena stipoides*) are found more abundantly, while brown-top and Danthonia pilosa, as well as Danthonia semiannularis, are still to be found, but in lower proportions. The main difference is seen in the lower palatability of the pastures, the more sparsely covered bottom, and the slower growth in spring.

Hillersden hill country has many characteristics in common with parts of North Canterbury. There are, however, essential differences: the winters are milder and shorter, hence the wintering of sheep does not present the same problem; the rainfall is heavier and fairly well distributed, excepting that the summers tend to be dry. Although the rainfall is good, the north-westerly wind, as in Canterbury, blows with great frequency and so renders the ground drier than it would otherwise be.

(2) The Sounds hill country: Here the climate is wet and mild, and winter conditions hardly exist. In addition to danthonia and brown-top, such grasses as paspalum are essentially of importance in Sounds pasture management. Naturally, under such conditions second growth, as represented by water-fern, bracken, tauhinu, and manuka, presents a serious problem. Such country, of the original "rain forest" type, resembles in many particulars some of the wetter and milder portions of the North Island, but, being in such close proximity to the sea, is on the sunny faces as warm in winter as parts of Auckland Province.

(3) The good limestone and papa country of the east coast, at Kekerangu: On this country English grasses, clovers, and some lucerne have persisted for twenty years without the application of artificial fertilizers. English grasses are now beginning to run out. An approximate analysis of the pasture at Ngaio Downs, Kekerangu, made at the end of July, gave the following percentages: Danthonia

pilosa, 50; cocksfoot, 15; perennial rye-grass, 18; Chewings fescue, 2; Yorkshire fog, 2; white clover, 3; tussock (*Poa caespitosa*), brown-top, Scotch thistles, horehound, and other weeds, 4; Poa pratensis, 3; lucerne, 1; yellow suckling-clover, 2.

The climatic conditions of the east coast may be described as mild and dry. Many parts of the front country experience only very light frost, while the frosts, of course, become more severe as one recedes from the coast. The driest period of the year may be set down as from December to April inclusive. English grasses on this country, in spite of the fact that a judicious system of fencing and stocking with cattle has been adopted, are now beginning to run out, and unless top-dressing becomes general it is probable that a complete reversion to danthonia and the lower-fertility-demanding types of grasses and weeds is imminent.

HILLERSDEN DISTRICT EXPERIMENTS.

In June, 1925, hill top-dressing experiments in the Hillersden district were commenced on the farms of Mr. R. Rentoul and Mr. W. McAlpine respectively, the latter property being taken over at the end of the winter of 1926 by Messrs. Fahey and Dunphy. In 1926 trials were also started on the property of Mr. F. L. Murray in the same district.

In the Hillersden district some store cattle are kept, but owing to the fencing difficulty and the relatively clean nature of the country the hills mainly carry sheep. This country may be classed as fair Merino country, and varies in winter carrying-capacity from half to three-quarters of a ewe per acre. The spring and summer of the 1925–26 season were extremely dry in this district. However, Mr. McAlpine reports that in the spring succeeding the first application of manure his carrying-capacity on this block increased practically 100 per cent. He also noticed the persistence with which sheep grazed on the manured blocks in preference to the unmanured areas. The scheme adopted was that of manuring acre blocks, with narrow unmanured blocks in between the areas top-dressed.

A similar arrangement was adopted on the other properties at Hillersden. In the first season the blocks ran as follows:—

(1) Superphosphate, 2 cwt. per acre.
(2) Check strip.
(3) Mixture of 1 cwt. super and 1 cwt. ground Nauru phosphate per acre.
(4) Check strip.

This series of plots was repeated three times, so that 6 acres were top-dressed in 1925 on each property.

In the 1926–27 season these areas were not top-dressed again, but the land top-dressed was extended, the reason for this being the consideration that it is unlikely that a farmer holding, say, 1,400 to 2,000 acres will be able to undertake the annual top-dressing of the same area of hill country. It is true that some farmers when they obtain good results in one hill paddock may top-dress that particular paddock annually to the exclusion of others. In the case of the Hillersden areas, however, the work has been carried out on the assumption that the farmer will naturally treat certain of his paddocks in rotation.

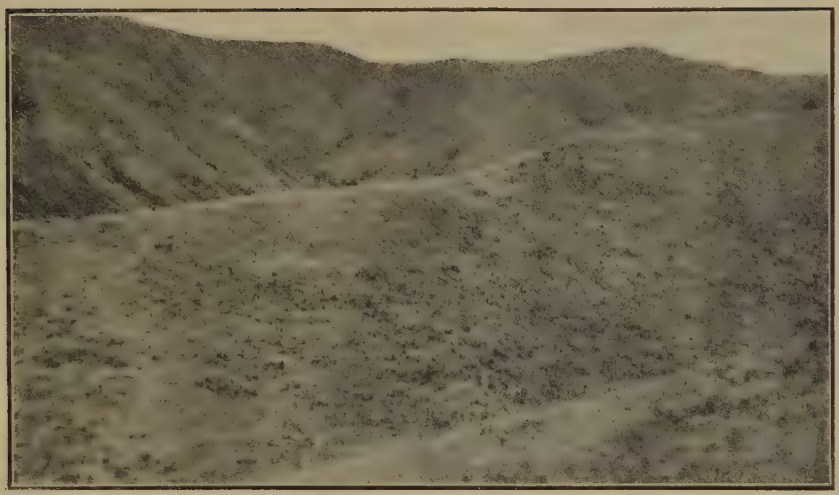


FIG. 1. GRASSLAND ON FAHEY AND DUNPHY'S FARM, HILLERSDEN.

This top-dressed area (in middle distance) had been shut up for some time when photo taken, and plainly showed much heavier growth on manured plots running down side of slope.

FIG. 2. PART OF TOP-DRESSED AREA ON R. RENTOUL'S FARM, HILLERSDEN.

Showing plot in foreground top-dressed with super in winter of 1925 closely grazed, with grass in adjoining unmanured control plot neglected by stock.

[*Photos by the Writer.*

In the late summer of 1926, at the foot of Mr. McAlpine's hills, the abundance of droppings from sheep on the manured plots as distinct from the paucity of droppings on the untreated strips was very noticeable. At first it appeared that better results were being obtained from the mixture of Nauru phosphate and super than from the super alone. The knowledge that the Hillersden country is very deficient in lime might lead one to suppose that better results could be obtained from a basic type of manure. The slight distinction which appeared at first, however, has now entirely vanished, the super plots being as good and in some cases better than those treated with the mixture.

Messrs. Fahey and Dunphy report very favourably on the results of the 1926 winter dressing, but they are too new on the place as yet to give figures regarding increase in carrying-capacity. During the autumn and the winter of 1927, however, the block has been shut up. The accompanying photograph (Fig. 1) of a sunny face, taken last May, shows how rankly the tussocks, danthonia, and other grasses have grown on the manured plots compared with the check strips. When such defined strips can be seen in the early winter the evidence in favour of top-dressing is indeed strong. A farmer on the wetter hill country of the North Island would probably take this as a matter of course. It may be pointed out, however, that in dry seasons in this district manures often act with exceptional tardiness. Even on fairly heavy flat country the writer has known the results not to show until eighteen months after the application of the manure. The dry spell which succeeded the application of the fertilizers in the present case was, of course, an exceptionally bad one.

Results on Mr. Rentoul's property have been much slower in showing themselves. The reason for this is not at present apparent. In the 1925 26 season very little defined difference from the manure was to be seen, either in pasture-composition or in the tendency of the stock to graze one plot with more avidity than another. At the end of the 1926–27 season, however, most pronounced and interesting differences were noted. Fig. 2 shows how closely the plot which was treated with 2 cwt. super per acre in 1925 has been grazed, while the rank brown-top and danthonia heads on the adjoining check plot are left untouched. This paddock has not been shut up, but rather has been fairly continuously stocked. It would appear that a period of about eighteen months has been necessary before the effects of top-dressing became distinctly discernible to the eye. Now, however, the results appear to be very satisfactory. All manured plots are beginning to show distinctions both in pasture-composition and in the preference shown for them by stock. If there is any difference at all on this area between the kinds of manure applied it is in favour of super rather than the super and Nauru-phosphate mixture. Mr. Rentoul estimates an approximate increase of one-third in carrying-capacity this past season. It is remarkable that plots on which manure was applied last winter (1926) have not been grazed so closely as those top-dressed in the winter of 1925.

Mr. Murray, who top-dressed a hill block in 1926, reports no difference as yet.

TRIALS IN THE SOUNDS.

The Sounds trials have now been in progress for one season. Owing to pressure of work, top-dressing operations were not carried out last winter until early August. Three areas were selected: (1) at Onapua, Tory Channel (Fig. 3); (2) Portage, Kenepuru Sound; (3) Hopai, Pelorus Sound. In all three cases the pasture of the blocks dealt with consisted mainly of danthonia and brown-top, tending to run out to moss and bracken fern. At Onapua the amount of second growth is more considerable than on the other areas. The slopes dealt with include both sunny and shady faces, but are in the main sunny. (This winter, work with the shady faces more particularly is being started at Yncyca Bay.) The area of land employed at Tory Channel is between 15 and 16 acres, at Portage 12 acres, and at Hopai 8 acres. Five fertilizer treatments have been under test.

(1) 3 cwt. superphosphate per acre.
(2) 3 cwt. ground Nauru phosphate per acre.
(3) 1½ cwt. super and 1½ cwt. ground Nauru phosphate per acre.
(4) 3 cwt. Ephos phosphate per acre.
(5) 3 cwt. basic slag (Belgian) per acre.

Trials on each area were carried out in duplicate, with check plots interspersed.

Last New Year's Day a farmers' field-day was held at Hopai. All who saw the plots on that occasion expressed surprise at the quick response so evident in the case of certain manures. On this occasion the transformation in the plot treated with basic slag was unique, yellow suckling-trefoil and white clover, as well as rye-grass and cocksfoot, replacing bare spaces, weeds, and danthonia to a large extent. The plot treated with Ephos phosphate also showed excellent results, but it has been subsequently found that these results have not persisted as well even as those from superphosphate. An inspection made on 15th June last showed that even in midwinter the results from basic slag are still very evident. On that date the plot treated with Ephos had receded from its second position in order of merit; the plot now appears almost as depleted as the adjoining control plot. The effects from the use of super not only persist but show steady improvement. At Portage an inspection was last made on 14th June, the following observations being recorded:—

Superphosphate plot No. 1 very much cleaner than adjoining control plot. Moss has given place to perennial rye-grass, white clover, and danthonia. Adjoining control plot, partly situated in a gully, fair, but poorer than plot treated with super.

Plots treated with ground Nauru rock phosphate still fairly poor. Adjoining control plot also poor.

Plots treated with mixture of super and ground Nauru phosphate much brighter green. Thicker bottom than on adjoining control, on which the seed-heads still remain uneaten.

Ephos plots fairly poor. Control plot situated between Ephos and slag plots shows distinct opening out of the pasture. Catsear and rib-grass showing to a marked extent.

Basic-slag plots very good. Big increase in clovers and English grasses. As yet, however, this area cannot be said to have shown results superior to those given by super.

FIG. 3. GENERAL VIEW OF TORY CHANNEL TOP-DRESSING AREA.

FIG. 4. PART OF TOP-DRESSED AREA ON A. H. DERBYSHIRE'S FARM, TORY CHANNEL.

Slope in middle view, treated with rock phosphate and super, grazed bare; long, ungrazed grass in foreground is on a control plot.

[*Photos by the Writer.*

By January practically all manures at Tory Channel were showing good results. It may be here mentioned that the Sounds country generally is very deficient in lime. Probably for this reason, also owing to the wet climate, basic manures seem to act very readily. At Onapua there was unmistakable evidence that on the wet, sour soil, ground Nauru phosphate, used alone, had brought back white clover, rye-grass, and yellow suckling-trefoil. On the ridges, however, results from this manure are practically negative, while superphosphate, both at Onapua and at Hopai, has evidently been instrumental in bringing grasses and clovers on what were originally bare, steep faces. The following notes were made on the occasion of the writer's visit on 13th June :—

Super plots : Even on faces and ridge cockfoot, rye-grass, and clover coming back in response to dressing. Pasture eaten very low by sheep and cattle, even fern-plants among the grass being eaten. Second growth in the shape of bracken fern on the adjoining control plot left untouched.

Nauru phosphate : On these plots fern has been eaten more than on adjoining control plots, but not so much as on super plots.

Basic slag : On first plot white clover coming back very thickly — more so even on poorer ground than on super plots. This plot easily best on area. Second basic-slag plot also shows excellent results.

Nauru phosphate and super plots : This mixture appears to have brought back white clover and danthonia at expense of moss and young bracken-fern plants.

Experiments in the Sounds have not proceeded far enough as yet for determining what increase in carrying-capacity may be expected from fertilizer top-dressing, nor just on what country it is going to pay to top-dress. Steps are being taken in the coming season to determine the economic position in regard to the sunny faces. Our plan is to proceed to deal with the country in order of its grade of fertility and its possibilities of improvement.

THE EAST COAST.

No very definite results have yet been obtained from the trials at Kekerangu, and report on this area is therefore deferred until another season's observations are available.

The Large White Pig in Denmark and Britain.—Replying to a recent inquiry relative to the utilization of the Large White pig for crossbreeding purposes in New Zealand, the High Commissioner, London, states as follows : "Mr. Harald Faber, the Danish Agricultural Commissioner in London, informs me that the Large White pig is being used less in Denmark than formerly, and that it is gradually being replaced by the Danish-bred pig, which was considered to be more suitable for breeding purposes and for the production of pork. This Danish-bred pig is the evolution of crossbreeding which has been going on for some years, the basis being a cross between the native pig and the Large White. He was not able to give me detailed information as to whether or not the size of bone entered into the question. The Ministry of Agriculture of England states that the Large White is very popular in this country for the production of bacon, and that boars of the breed are in great demand for crossing with other breeds with the same object in view. It is further stated that the Large White is not generally regarded as an ideal pig, when kept pure, for the production of first-class pork, but is suitable for the purpose when crossed with such breeds as the Middle White and Berkshire."

A RECONNAISSANCE SURVEY OF PUMICE SOILS.

ROTORUA COUNTY.

(Series continued from June, 1926.)

B. C. Aston, F.I.C., F.N.Z.Inst., Chemist to the Department of Agriculture.

V. MAPPING OF COUNTY BOUNDARY COMPLETED.

Resuming this series of articles, certain facts may be briefly restated. Pumice soils are of many qualities, ranging from good to bad. It is the aim of this survey to classify the leading types of soil in the areas where pumice soils occur, so that the response to treatment of given types in the settled areas may be predicted for the same types occurring in the less settled and therefore less known districts, the climate being the same. In making any statements as to the quality of any soil in the volcanic soil-province it is highly desirable that the soil should be called by the right technical name. These names are all familiar terms, such as "gravel," "sand," "silt," "loam," prefixed by the adjectives "coarse" or "fine," and when the proportions are fairly balanced a compound name is used. Thus some half-dozen familiar words in different combinations may be used to describe accurately* all the kinds of soil dealt with in this article.

With the areas mapped and distinguished by a distinctive pattern shading for each soil-type, it will be easy for those interested to determine to what type any area belongs. It is not to be denied that small patches of soil may occur which are not representative, but the owner of such land must recognize the substantial accuracy of the mapping. This careful work—which has been the outcome of much laborious effort in the field and detailed investigation in the laboratory on the part of an efficient staff—again shows the persistence of each of the wind-deposited soil-types over a very large area. The findings of the work on the northern half of Rotorua County have been largely borne out in the results obtained in the southern half. These are presented in the accompanying map and tables.

As one would expect, those soils which have been distributed through air alone—not having been altered by running water—are uniform throughout their boundaries. In this southern map, however, two new conditions confront one which are highly interesting and probably of great economic value, for here is disclosed the presence of a very large area of water-borne soils of quite a distinct type (silts) from any yet found in the northern part of the county. Also there are—no doubt as a sequential effect—some smaller areas containing swampy soils. Evidently some river in the past has deposited this silt soil. The significance of this discovery is that iron-starvation (bush sickness) in ruminant stock is not known to occur in soils which are finer in texture than a sandy silt, *and here is a large area of finer soil* than a sandy silt.

* The limits of the use of each term are defined, each term denoting a soil with a definite proportion of particles of each size, the largest size being gravel and the smallest clay particles.

Table 1.—Chemical Analyses of Soils, Southern Half of Rotorua County.

(Results, except *, are percentages on soil dried at 100° C.)

Laboratory Number.	Description of Soil.	Volatile Matter.		Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification. ("Available Plant-food.")				Hydrochloric-acid Extract. ("Total Plant-food.")			
		*At 100°C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5	Lime, CaO.	Magnesia, MgO.	Potash, K_2O.	Phosphoric Acid, P_2O_5
267	Composite sandy loam	1·64	4·43	0·070	0·146	0·043	0·028	0·008	2·00	1·42	0·50	0·10
268	Composite fine sandy loam ..	1·19	3·22	0·045	0·144	0·040	0·033	0·011	2·22	1·25	0·62	0·04
269	Composite silt	2·31	10·06	0·209	0·098	0·024	0·020	0·004	0·42	0·18	0·10	0·05
270	Composite coarse sandy silt ..	0·87	4·24	0·076	0·085	0·027	0·018	0·004	1·64	0·89	0·21	0·02
271	Composite sandy silt (Tarawera)	3·10	9·83	0·196	0·105	0·037	0·022	0·005	0·80	0·40	0·21	0·06
272	Composite sandy silt	1·27	4·74	0·075	0·090	0·027	0·018	0·003	1·53	0·74	0·23	0·02

Analyses by F. J. A. Brogan.

It does not appear that the essential difference in the quality of the Atiamuri Road silts from the sandy silts of the Rotorua series has been recognized before, or, if recognized, it has not been explained. Settlers have claimed, however, that their land here is not "bush sick," and science now supports them and supplies the explanation.

It is satisfactory to know that the area opened by the Lands Department under the "inferior lands for selection scheme" is situated on the silty soils of greater fineness than a sandy silt. The importance of a small increase in the fineness of the soil-texture has been fully stressed in previous articles. The increase of the clay content in one case from 1 per cent. to 5 per cent. has made all the difference between "healthy" and "sick" cattle-country.

The soils dealt with in this article will all come under series "C," a series first found on the east side of Lake Rotorua and consisting of varying depths of the mud and other material ejected from Tarawera. Chemical analysis sharply defines these soils from soils of the same texture belonging to another series, but the present article deals with seven types, whereas in the previous survey only two types were described (see *Journal*, June, 1926, p. 368). These were described fully in the *Journal* for December, 1924, pp. 378–79. Series "C" are usually finer than any other series of the Rotorua County, from which they are always characterized by the top soil having a much higher lime and magnesia content (neither present in the form of carbonate), and they may be regarded as the healthiest soils in the county.

In this article the following types of series "C" are enumerated in the decreasing order of their fineness; only Nos. 1 and 2 occur in the northern part of the county mapped in the *Journal* for June, 1926.

Type No.	Name.	Area.
1.	Sandy loam }	60 sq. miles.
2.	Fine sandy loam }	
3.	Silt	103 ,,
4.	Coarse sandy silt ..	22 ,,
5.	Sandy silt (Tarawera S.D.) }	290 ,,
6.	Sandy silt .. .. }	
7.	Fine gravelly sand ..	47 ,,

Composite samples were made up from the individuals of the first six of these types and analysed chemically, with the result that all except No. 3 (silt) showed a close relation to the Te Ngae series ("C" types 1 and 2). With regard to the silt, in the chemical analysis it compared very favourably with the sandy silts of Mamaku (series "A"); in addition, the mechanical analysis is such that the

Table 2.—Mechanical Analyses of Soils, Southern Half of Rotorua County.

(Results are percentages on air-dried soil.)

Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.								Stones and Gravel.
	Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.	
Fine gravelly sands, Ruawahia S.D.—									
Maximum	31·3	54·5	21·8	13·2	6·3	1·8	1·7	6·5	73·5
Average	27·0	39·0	16·9	7·5	3·2	1·0	0·9	3·7	48·4
Minimum	22·7	25·0	13·1	2·2	1·1	0·4	0·2	0·8	33·3
Coarse sandy silts, Kaingaroa S.D.—									
Maximum	22·8	43·7	23·3	18·4	9·4	4·3	1·4	5·5	71·4
Average	11·6	36·9	22·3	15·6	6·4	1·7	1·0	4·5	39·1
Minimum	5·6	20·0	21·1	12·9	3·1	0·9	0·8	4·1	20·0
Sandy silts, Ngautuku S.D.—									
Maximum	12·1	22·5	33·8	36·4	8·9	4·3	3·8	14·6	11·1
Average	5·9	15·8	26·6	30·6	5·9	2·5	2·5	10·9	8·2
Minimum	2·3	12·8	21·4	22·8	2·5	1·4	1·4	7·4	5·2
Sandy silts, Horohoro S.D.—									
Maximum	7·2	26·4	27·4	29·1	9·8	3·7	6·6	14·7	12·9
Average	4·9	17·7	25·0	26·8	7·7	2·2	3·8	12·4	9·2
Minimum	3·0	13·9	21·6	21·2	5·2	0·5	2·1	9·2	4·5
Sandy silts, Ngongotaha S.D.—									
Maximum	11·1	28·9	29·6	29·4	6·4	3·1	3·0	15·8	37·0
Average	7·3	20·8	24·6	25·8	5·2	1·8	2·7	12·0	19·5
Minimum	4·4	16·8	20·6	19·7	3·6	1·3	2·2	9·8	12·8
Sandy silts, Tarawera S.D.—									
Maximum	12·1	30·6	33·1	31·2	10·9	4·2	4·4	13·8	17·8
Average	6·6	19·8	28·0	23·0	7·7	1·9	3·3	10·1	7·2
Minimum	3·0	16·2	22·8	15·0	6·1	0·8	2·3	6·4	2·1
Sandy silts, Paeroa S.D.—									
Maximum	9·2	28·8	29·6	30·5	9·4	3·0	4·1	10·6	28·5
Average	6·4	18·4	26·6	27·7	7·2	1·6	3·1	9·4	15·8
Minimum	4·9	13·5	22·1	18·3	5·0	0·8	1·8	7·7	7·1
Sandy silts, Kaingaroa S.D.—									
Maximum	19·2	35·9	36·5	29·5	12·2	4·0	2·4	9·1	66·7
Average	6·0	24·8	29·9	22·6	7·0	1·8	1·4	6·0	17·7
Minimum	1·0	15·5	25·2	17·6	3·8	0·6	0·7	2·2	4·5
Sandy silts, all districts—									
Maximum	19·2	35·9	36·5	36·4	12·2	4·3	6·6	15·8	66·7
Average	6·0	19·8	27·3	25·8	6·9	1·9	2·7	9·7	12·7
Minimum	1·0	12·8	20·6	15·0	2·5	0·5	0·7	2·2	2·1
Silts—									
Maximum	5·3	13·4	32·7	38·1	16·1	5·6	8·4	18·4	35·7
Average	3·4	10·4	26·7	34·1	9·4	2·0	3·3	10·3	16·1
Minimum	1·8	7·9	21·0	29·7	6·3	1·1	1·5	7·7	4·9
Fine sandy loams—									
Maximum	7·1	11·7	38·5	25·9	17·0	11·5	1·2	4·5	29·3
Average	4·0	9·5	33·9	23·7	15·2	9·9	1·0	3·4	15·6
Minimum	2·5	5·8	30·0	21·8	12·1	8·4	0·8	2·4	4·9
Sandy loams—									
Maximum	22·3	30·5	32·9	28·7	19·3	11·1	2·2	9·3	57·1
Average	7·6	18·5	25·6	20·4	14·8	8·6	1·5	3·7	20·9
Minimum	2·2	12·1	17·9	13·1	10·8	6·9	1·0	1·9	5·7
Averages.									
Fine gravelly sands ..	27·0	39·0	16·9	7·5	3·2	1·0	0·9	3·7	48·4
Coarse sandy silts ..	11·6	36·9	22·3	15·6	6·4	1·7	1·0	4·5	39·1
Sandy silts	6·0	19·8	27·3	25·8	6·9	1·9	2·7	9·7	12·7
Silts	3·4	10·4	26·7	34·1	9·4	2·0	3·3	10·3	16·1
Sandy loams	7·6	18·5	25·6	20·4	14·8	8·6	1·5	3·7	20·9
Loams (only two samples analysed)	4·0	9·5	33·9	23·7	15·2	9·9	1·0	3·4	15·6

Analyses by L. D. Foster, assisted by D. F. Waters and E. B. Davies. Samples collected by R. F. Grimmett.

series "C" silt in its fineness and consequent capacity to hold water is greatly superior to the series "A" sandy silt. Series "C" offers a very good example of the necessity for classifying the soils of the same mechanical fineness into series according to their chemical as well as their physical characters. The two sandy silts of series "C" are greatly different from those of series "A" in their chemical composition, and no doubt in their productiveness and freedom from iron-hunger.

Some Features of the Volcanic Soil-province.

The following are some of the outstanding features which confer distinction on soils of the volcanic soil-province when compared with other normal soils of the North Island which are devoted to the same kinds of farming.

It cannot be denied that those lands in the soil-province which are not already closely settled (such as are those in the Rotorua Lake basin) are cheap compared with other lands of similar productiveness in the North Island. The soil is such that with few exceptions it may be worked in all weathers. It is comparatively accessible, and service motor-coaches ply with great regularity throughout the year and connect with the railway services at the Rotorua rail terminus with the East Coast Railway and with the Napier Railway terminus. Throughout the North Island there are many instances of fertile lands with poorer means of access.

The climate may be claimed as one of the best in the world, and although the rainfall is high the water gets away remarkably quickly through the porous soil, so that except in one respect this country is an ideal one for both man and animals. The freedom of locally raised stock from tuberculosis has been noted, and the writer believes this feature also applies to the human population. The absence of tubercle is, indeed, so remarkable as to prompt inquiry as to the cause. The writer—in many analyses of the natural waters of this district, whether surface waters or those from springs or rivers—has always found an excess of dissolved silica to be present in the total mineral matter left after evaporation of the water, and it is an interesting fact that silica is used in medicine as an alleviative of some forms of tuberculosis in humans. Gonnermann ("Biochemistry of Silicic Acid," 1917) has observed that silica is present in most animal tissues, and that good results have been observed to follow the administration of silicic acid in cases of tuberculosis. Most herbs contain considerable quantities of silica, and it is found on analysis that those herbs which are used by the country folk of Middle Europe for the cure of tuberculosis contain the largest percentages of silica (Abstract in the *Journal of the Chemical Society*, August, 1917, vol. 112). People of weakly constitution and others with weakly children coming to live in the pumice country often experience great relief from anxiety on the score of health after a few months' residence.

The health of stock is remarkable in yet another respect—freedom from bone-nutrition troubles. Disease of the bones often occurs in certain districts of the North Island in certain years, especially in milking-cows. The absence of this trouble on the pumice lands seems to show that the amount of the bone-making minerals in the soil and pasture never sinks below that required for the production of healthy

bones in the animal. A very small amount of phosphate is shown to be present in the soil by methods designed to estimate the available or the total phosphoric acid, and this is another fact that requires an explanation.

Clovers thrive amazingly on all the pumice lands, and the clover is a plant which likes phosphates and potash to be present in the soil in good amount. But available silica has the faculty of making phosphates more assimilable by the plant within the plant, so that if silica is available in the soil and is taken up more freely by the plant than is usually the case, the plant may be enabled to assimilate more phosphoric acid than it would otherwise. It is not to be denied, however, that phosphates are destined to play an important part in the development of this volcanic country.

Phosphates improve the carrying-capacity of all types of soil by increasing the quantity and quality of herbage per acre. The fact that this soil-province is situated comparatively near to the great phosphate receiving and distributing centre of Auckland City is another fact in favour of the pumice land as a whole. In connection with the coarser grades of pumice, for anything coarser than a silt it is best to keep the soil-reaction acid, which inhibits the use of such alkaline dressings as are supplied by most forms of lime. There is no doubt that lime will have to be distributed on many North Island lands in increasing quantities in the future, but on the coarser pumice lands it will not be good practice to apply lime for very many years; not only is lime now unnecessary, but it is even harmful. Thus another point in favour of pumice lands is that the expensive practice of liming may be dispensed with. The three fertilizer ingredients—nitrogen, potash, and phosphoric acid—are arranged thus in the order of their cost. Nitrogen is most expensive, potash comes next, and phosphates are the cheapest per unit. Now, all pumice lands, even when unmanured, grow clovers and leguminous plants freely, thus providing a useful method of supplying nitrogen when the plant-roots decay in the soil or a leguminous crop is ploughed in. Potash is already abundant in the soil, so that the only ingredient to be supplied is the phosphate, the cheapest of all three fertilizers.

The volcanic soil-province is fortunate in having many subsidiary sources of income. The tourist traffic supports the thriving town of Rotorua, with its famed sanatorium, and provides a source of revenue to near-by farmers who are farming on healthy country. The traffic is also largely responsible for keeping open the many highways and constant communication with all parts throughout the year.

Sawmilling employs numbers of hands, and is one of the most important industries of this area. Cheap timber of excellent quality is thus provided. The sawmiller is the logical precursor of the farmer in timbered country, making tracks and tramways in all directions.

Many industries which may help to cause the pumice lands to flourish are in their infancy, but they will undoubtedly grow and prove an additional source of revenue to these lands. Pumice-powder for insulating and other purposes has merely to be dried, ground, and bagged. Sulphur will be a great asset if deposits can be located sufficiently large to work. At present practically all the sulphur required for manufacturing purposes in the Dominion is imported from America.

Pumice soil is one of the best for raising horticultural plants from seed or cuttings. It has a peculiar character which may be termed a frothy porosity, which is unequalled for establishing young plants. All kinds of horticultural plants, whether herbs, shrubs, or trees, could be raised in this area, and supplied to less fortunate localities as very hardy, well-rooted plants, with an abundance of fibrous roots. The Rotorua Sanatorium gardens well demonstrate the horticultural possibilities of the district, for the abundant rainfall, porous soil, and genial climate have certainly here produced wonderful results.

The forestry possibilities of the pumice country are now fully recognized, and commercial organizations are following the lead given by the Government by investing large sums in establishing exotic plantations. The artificial growing of flax is one to be experimented with in the future. The soil seems singularly suited to the growth of *Phormium tenax*.

Poultry and pig farming are capable of great development. The pumice lands are adjacent to the Bay of Plenty, which grows maize to perfection. Clovers, artichokes, peas, and other legumes grow well and make excellent food for pigs. Bee-farming is likely to afford an excellent side line to the farmer on country where clovers grow to such excellence.

Why, then, with all these advantages do the pumice lands lag behind in farming development? It would seem that there is one main explanation — the fear of "bush sickness" is the deterrent to a much closer settlement, and the absence of any authoritative guide, with reasons, as to what is "sick" and what is healthy country, results in the whole area receiving the same stigma. It is the aim of the present soil survey to differentiate lands of varying quality, mapping and applying appropriate names to each type. Eventually it is hoped to publish a map which will without any doubt set down the definite areas which are unhealthy, together with the relative degree of unhealthiness for ruminant stock which each type of soil exhibits. This knowledge can then be used in combination with the appropriate methods of farm-management which have been demonstrated so successfully at the Department's Mamaku farm and elsewhere.

(To be continued.)

Handling of Fat Stock in Transit.—The following remarks are made in the annual report of the Meat Producers Board for 1926–27: "The Board would again take the opportunity of pointing out to farmers and buyers handling stock the importance of the careful handling of all fat stock whilst in transit to freezing-works. It may not be generally known that a great many lambs graded second class are put into this grade on account of bruising; and from investigations made by officials of the Board it has been found that a good deal of this bruising has been caused through pulling the lambs by the wool, particularly in trucking. The loss that takes place from this cause should be a matter of concern to every farmer. As an illustration of the damage which takes place in this direction it may be noted that in a report received from one of the Board's graders he mentions that in a lot of lambs inspected at a freezing-works he counted 101 second class, forty-three of which would have gone into the prime grades but for bruising, whilst a number of the second-quality lambs were also bruised, and out of ten rejections seven were on account of bruising."

GOVERNMENT CERTIFICATION OF SEED POTATOES.

SYSTEM TO BE INITIATED IN CANTERBURY.

J. W. HADFIELD, Instructure in Agriculture, Christchurch.

THE Fields Division of the Department of Agriculture has arranged to initiate a system of certification of seed potatoes within the Provincial District of Canterbury during the coming season, 1927–28. If the scheme receives due support from growers, merchants, and seedsmen it is intended to extend it in succeeding years to embrace the whole of the Dominion.

Certification of seed potatoes has been adopted by a number of other countries, and the principle has in most cases been extended to include other farm-produce used for seeding purposes, such as cereals, clovers, lucerne, and grass-seeds. While, however, there is ample scope for such extension in New Zealand, the most urgent need would appear to be in connection with potatoes, owing to the present very unsatisfactory standard.

The object of potato-certification is to place before growers, merchants, and seedsmen information which will enable them to obtain "seed" true to name and free from serious disease. Obviously, this will necessitate inspection by qualified inspectors of both the growing crop and the produce derived from that crop. With a view to stimulating the distribution of such seed, and as a measure of protection against misrepresentation, growers of certified seed will be registered, and to each will be issued a certificate and a sufficient number of certification-tags to enable one tag to be attached to each sack of certified potatoes. Further, it is proposed to publish the names of such certificated growers in the *New Zealand Journal of Agriculture*.

REASONS FOR INTRODUCTION OF POTATO-CERTIFICATION.

(1) Mixed State of Varieties.

Every one associated with the potato trade in this country—either as grower or dealer—will readily acknowledge that varieties are badly mixed and sometimes incorrectly named. For example, during the season 1926–27 sixty-two lines, consisting of twenty-one varieties of potatoes, were grown at the Ashburton Experimental Farm. These had been collected from seedsmen and growers in Canterbury, Otago, and Southland, and, in view of the object for which they were collected and a definite request that they should be true to name, were almost certainly representative of a higher standard than that existing in the general crops of the Dominion. Of these sixty-two lines, seven were wrongly named, and the remainder contained an average of 7·8 per cent. of rogues. Northern Star, or Gamekeeper, proved to be by far the most common impurity in the white-skinned potatoes, and the proportion will increase at a remarkable rate owing to the tendency of this variety to produce an abundant crop of seed-size tubers.

The Dakota is an example of a variety of undoubted merit now rapidly going out of favour owing to the presence among it of yellow-fleshed varieties of poor cooking-quality (Scotia and Russet Reading), and of varieties in which the pink coloration sometimes extends into the flesh.

Extensive areas of potatoes are being grown and the produce sold under incorrect names, and in a few cases two closely similar varieties have merged into one mixture which is sold under the name of either. The position has become so unsatisfactory that there is a demand from all sides for seed potatoes which are true to name. Certification will undoubtedly fill this need, and at the same time record type descriptions, and clear up the confusion existing in regard to nomenclature of varieties that are being grown commercially in New Zealand.

(2) Prevalence of Disease.

To the merchant and grower varietal impurities will represent the most urgent need for certification. The fact remains, however, that in New Zealand, as in other countries, disease is really the more important factor and is causing very serious loss to the grower. Examination of crops during the past season has revealed conditions that are far from satisfactory, more especially in connection with those diseases that are not commonly recognized by growers—for example, corticium, and virus and wilt diseases.

In the trials previously referred to, conducted at the Ashburton Experimental Farm, a count was made of those plants obviously below the general standard—somewhere about 50 per cent. or more. It was made regardless of the cause, and revealed 26·7 per cent. of subnormal plants. Exactly how much loss is being experienced by growers is difficult to estimate, and investigation along these lines is being undertaken. Indications are that the loss must be of considerable importance, yet these conditions are those not generally recognized as specific diseases, although the farmer will readily acknowledge that his seed has "run out," and that a change is desirable.

The Up-to-Date still remains one of our best commercial varieties, provided a satisfactorily healthy strain can be procured. Some very fine crops of this variety are still grown, but it appears particularly liable to infection from wilt, and crops that are even moderately free from this disease are comparatively rare. Mr. J. W. Calder, of Canterbury Agricultural College, is at present engaged in raising a strain free from this disease, and during the past season (from four long rows in the paddock) has compared the yield from wilt-infected shaws with that obtained from plants showing no sign of infection. The results supplied by Mr. Calder for the one season and the one crop are an indication of the possible loss occasioned.

Number of plants dug	500.
Number of healthy plants	88 = 17·6 per cent.
Number of wilt-infected plants	412 = 82·4 per cent.
Actual yield of 88 healthy plants	190 lb. = 100 per cent.
Actual yield of 88 diseased plants	65 lb. = 34 per cent.

Since no means of direct control is applicable to the great majority of potato-diseases, avoidance of sowing diseased seed would appear to be the most practical method of improving conditions as they are

at present. Many of the diseases can be recognized only while the crop is growing, by one who is acquainted with the symptoms, and an essential part of the certification system is the accurate estimation of the proportion of these diseases at regular periods of inspection. Avoidance of the disease is effected by certifying clean crops, thus stimulating the distribution of healthy strains and indirectly suppressing the use of unsatisfactory seed.

Progress may not be rapid, because it must be recognized that in some cases infection is transmitted in the field by various agencies and from year to year in the soil. The fact remains, however, that the use of infected seed is the primary cause of the distribution of these diseases. E. J. Fawcett pointed out in this *Journal* for November last that in Canterbury less than 2 per cent. of farmers grow potatoes after potatoes, and over 76 per cent. grow them following grass. Under these conditions one would be justified in supposing that soil-infection is not a very important factor in the distribution of potato-diseases.

There are growers who regularly and successfully produce pure seed, but there is not sufficient of this to meet the demand, nor any organized attempt at the elimination of disease beyond the very excellent practice of planting cut sets of table potatoes every few years.

WHY GROWERS AND MERCHANTS SHOULD SUPPORT CERTIFICATION.

The present position of a farmer desiring a change of seed is far from satisfactory. A change is certainly desirable, provided he is satisfied that the seed being introduced is definitely better than his own, but so frequently does this practice lead to disappointment that obviously some system of certification would be of material assistance in indicating to the purchaser the best crops from which to obtain his seed. There is always an element of risk unless he is actually acquainted with a grower of pure seed and has had an opportunity of inspecting the growing crop.

The purchase of seed on the open market, without any knowledge of its origin or of the quality of the crop from which it was produced, is a risk which no commercial grower should be forced to take. As already indicated, in many instances the presence of disease can be detected only by an examination of the growing crop, and recent work at the Ashburton Experimental Farm clearly indicates that what appears to be an excellent line of seed may be incapable of yielding more than a few sacks of table potatoes to the acre.

The merchants are also faced with difficulties in the handling of seed potatoes. Certification will play no part in the supervision of grading standards, but it should most definitely assist merchants in determining the suitability of crops for seed purposes. It is unavoidable that a large proportion of seed submitted to merchants is the produce of crops that have not been inspected during growth, and sales are arranged according to the appearance and grading. As this amount of evidence is not sufficient indication as to the value of a line for seed purposes, it follows that purchases are made with little confidence. Seedsmen and merchants are the first to acknowledge that if it were possible to remove the element of risk and uncertainty in the purchase of seed potatoes they would be in a position to pay a higher price to

the producer. It may be assumed that certification will assist in this direction, and that part of its value will be reflected in the higher prices paid to growers for certified seed.

VARIETIES ELIGIBLE FOR CERTIFICATION.

Obviously, it would be impossible to certify in regard to all varieties grown in New Zealand. As a result of inquiries made from merchants throughout the South Island it has been decided to include within the scope of the first year's operations the following varieties :—

Arran Chief.	Aucklander—Short Top.	Early Regent.
Dakota.	Sutton's Supreme.	Early Puritan.
Bresee's Prolific.	British Queen.	Robin Adair.
Gamekeeper.	Epicure.	King Edward.
Northern Star.	Pink Beauty of Hebron.	Magnum Bonum.
Up-to-Date.	Early Rose.	Endurance.
Aucklander—Tall Top.		

THE GROWER'S PART.

Any one intending to plant on his own land or on contract during the 1927–28 season 1 acre or more of a pure line of any of the above-listed varieties may make application for certification on a form supplied for the purpose and available from the Instructor in Agriculture, Christchurch. Applications must be forwarded to the Manager of the Experimental Farm, Ashburton, and be accompanied by 100 seed-size tubers, freight paid. Applications close on 30th September, and, for reasons already explained, will be restricted during the coming season to areas grown in Canterbury. In the event of a crop passing the necessary standards the owner will be required to keep and submit a record of sales.

Prices and standards of grading are matters outside the scope of certification, but it is necessary for the Department to keep a record of those to whom certified seed is sold and the quantity of each sale. This means that the responsibility is upon the grower to account for the exact number of certification-tags issued to him, and this affords the only means by which the Department can trace any particular line in the event of misrepresentation and complaints.

INSPECTION OF CROPS.

The trial sample submitted by the grower will be planted under uniform conditions with all other lines submitted, and thus enable a ready comparison to be made between the standard of any one and that of the rest of the samples submitted. The first field inspection of the farmer's crop will take place during January, and the second inspection just prior to the shaws maturing. Final tuber-inspection will be made after harvest, when the tubers have been graded and are in sacks. These sacks need not be those in which the tubers are to be marketed, but it will be impossible to certify seed that is in pit, and it is essential to the satisfactory working of the system that the number of certification-tags issued shall correspond with the number of bags for sale.

STANDARDS.

Standards will be set during January of each year, after careful examination and comparisons have been made of the plots grown from the samples submitted by growers.

A uniform system of counting will be adopted at each inspection, in order to determine the percentage of foreign and diseased plants present. Standards will be progressively higher with each inspection. A crop containing 5 per cent. of foreign varieties at the time of the first field inspection may pass at that stage, but the grower will almost certainly be called upon to rogue the crop and materially reduce this percentage to enable it to pass the second field inspection. Information along these lines will be given by the Inspectors at the time of inspection.

ISSUE OF CERTIFICATES AND CERTIFICATION-TAGS.

A certificate will be issued to the grower in regard to each variety that passes the necessary standard, together with sufficient certification-tags to enable him to attach one tag to each sack of certified tubers that he sells from his farm for seed purposes. The tags are in the nature of a guarantee by the grower as to the contents of the sack to which the tag is attached. They will be printed on each side respectively as follows :—

[*On the front.*]

NEW ZEALAND.

GOVERNMENT-CERTIFIED SEED POTATOES.

Variety : .....
Name of grower : .....
Date : ..... Regd. No. .....
.....Inspector.

[*On the back.*]

This tag is issued for one sack of potatoes of between 180 lb. and 200 lb. gross weight, and is to certify that satisfactory evidence has been given that the contents have been grown by the person whose name it bears, and that they have been inspected in the field and after harvest by an officer of the Department of Agriculture, and have been found sufficiently vigorous and free from serious diseases, other pests, and foreign varieties as to warrant them being classed as Government-certified seed potatoes. This tag is issued on the express condition that the person to whom it is issued and whose name it bears undertakes to grade the potatoes for which it is to be used, so that they shall be practically free from earth, rotted or otherwise seriously injured or blemished tubers, free from all foreign or off-type tubers, and that the grading shall be in accordance with arrangements entered into between the said person and the purchaser, and on the further condition that the said person assumes entire responsibility for the contents of any package to which this tag may be attached by him.

APPLICATIONS FOR CERTIFICATION CONFIDENTIAL.

A grower may make application for certification with full confidence that no publicity whatsoever will be given in regard to his crop until such time as it has been passed and certified. The fullest publicity will then be given in regard to growers' names, varieties, and quantity of seed available. A grower, therefore, need have no hesitation in applying, for he loses nothing by entering and failing, and may gain much by entering and passing.

CONCLUSION.

There are bound to be many difficulties ahead of certification, and it is only by the whole-hearted support of growers and merchants, and their free and constructive criticism, that the scheme will be carried through to a successful issue.

PARASITES OF THE PEAR-MIDGE (*Perrisia pyri*).

COLLECTION OF MATERIAL IN FRANCE, 1926.

R. C. FISHER, B.Sc., Ph.D., Imperial Forestry Institute, Oxford.

DURING 1925 a first attempt was made to collect in France parasites of the pear-leaf-rolling midge (*Perrisia pyri*) for shipment to New Zealand. A description of the work carried out in the Dominion by the Government Entomologist, Mr. David Miller, on receipt of the consignments despatched to Wellington, was published in this *Journal* for June, 1926. Of the hymenopterous parasites observed in France (a species of *Platygaster*, a species of *Inostemma*, and possibly two species of chalcid) the *Platygaster* was the most abundant. Mr. Miller relates that from the 1925 consignments forty-six female and twenty-six male *Platygaster* adults emerged in New Zealand. Only one specimen of a chalcid and no *Inostemma* adults were obtained in New Zealand from this collection of material from Europe.

A request was made by the New Zealand Department of Agriculture for further supplies of parasitized *Perrisia* material from France during the summer of 1926. As was pointed out in the report on the 1925 collection, work had been undertaken rather late in the season to hope to obtain the maximum quantity of parasitized midge-larvæ. Accordingly it was requested that consignments be sent out during the whole summer at regular intervals. The matter was placed in the hands of Dr. G. A. K. Marshall, of the Imperial Bureau of Entomology, who asked the writer if he could again undertake the collection work in France. Owing to his duties with the Forest Products Research Laboratory the writer was unable to proceed to France for a long period to undertake the work personally, as in 1925. He proposed to visit France for a week in order to find some one to carry out the collection of material during the summer and in order to organize such a scheme. Leave was obtained for this, and in the beginning of July, 1926, the writer proceeded to Paris, to the Station Entomologique, Dr. Paul Marchal's laboratory, from which collections had been carried out along with Dr. J. G. Myers in 1925.

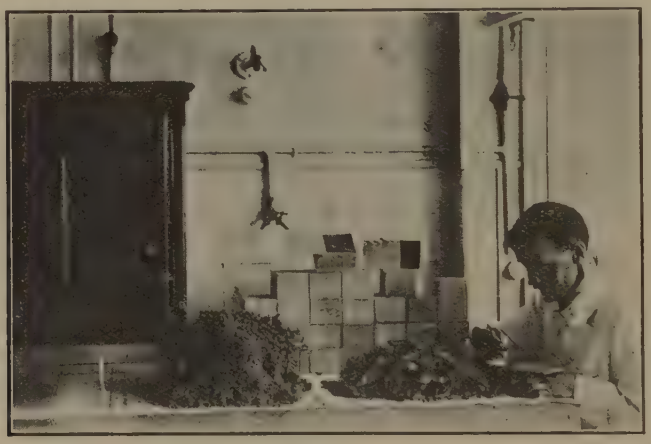
COLLECTION OPERATIONS.

Arrangements were made with M. Lucien Bru, *préparateur* at the Paris entomological laboratory, for larvæ of *Perrisia pyri* to be collected and despatched to the High Commissioner for New Zealand in London throughout the period from July to October. It was extremely fortunate to secure the services of M. Bru, who had seen this work carried out the previous year and could be relied upon to undertake it with enthusiasm and care. M. Bru spent several days in company with the writer, in orchards in the neighbourhood of Paris, searching for localities in which the pear-midge was most abundant, and becoming thoroughly acquainted with the type of material he had to collect. The majority of the collections were made from the same orchards as the 1925 consignments — at Versailles and at Seau-Robinson. Two collections, however, were made at Angers, in the Anjou district of France, where, in July, a severe *Perrisia* infestation

was noticed by M. Trouvelot, entomologist at the Station Entomologique, Paris. M. Trouvelot himself very kindly undertook to arrange for collection in this locality for the July consignment. In September a further supply of material was collected from Angers by M. Bru. Full particulars regarding the localities from which each consignment had been gathered were included with the material when shipped to New Zealand.

PACKING AND DESPATCH.

In all, four consignments were despatched during the summer. Larvæ of *Perrisia pyri* were collected in the rolled-up attacked pear-leaves. These were kept in an ice-chest in the laboratory at Paris at a temperature of from 12° to 14° C. during the months of July and August. In this way it was hoped to retard the development in Europe of both host and parasite larvæ. Each month a consignment was



PREPARATION OF CONSIGNMENT OF PARASITES AT THE PARIS ENTOMOLOGICAL STATION.

Showing M. Bru at work on pear-leaves containing larvæ of *Perrisia pyri*; ice-chest in background.

prepared for shipment and despatched to London. The procedure was as follows: Pear-leaves containing larvæ of *Perrisia* were packed among damp sterilized sphagnum moss in small boxes, 4½ in. by 3½ in. by 2¼ in. in size. A layer of sphagnum alternated with a layer of attacked pear-leaves. The sphagnum moss had been treated to a high temperature in an autoclave to ensure the destruction of any organisms which might have been present in it. The accompanying photo illustrates the preparation of the September consignment by M. Bru. The small boxes were then tied up in pairs and sent per registered post to the High Commissioner for New Zealand, London, to arrive there three days before the date of departure of a vessel for Wellington. Dates of sailings had been obtained previously from the High Commissioner's Office in London, and arrangements made for cold storage, if necessary, prior to the packages being placed in the vegetable-chamber of the boat for shipment to New Zealand. Care

was taken to ensure that as little time as possible elapsed between the departure of the material by post from Paris and its disposal in the vessel at the London docks. The size of each consignment varied, the greatest quantity being sent in August and September.

The following table gives a summary of the size of each consignment, together with the dates of despatch from Paris and London, as well as the localities from which each had been collected :—

Consignments of Perrisia pyri Larvæ despatched from France, Summer, 1926.

Consignment No.	Date of Postage in Paris.	Date of Sailing of Vessel from London and Name.	Number of Parcels in Consignment.	Total Number of Small Boxes.	Locality of Collection.
1	July 22	July 28; s.s. "Remuera"	9	14	Versailles, Angers, and Seau-Robinson.
2	Aug. 21	Aug. 28; s.s. "Rotorua"	8	16	Versailles and Seau-Robinson.
3	Sept. 18	Sept. 22; s.s. "Ruahine"	10	20	Versailles, Seau-Robinson, and Angers.
4*	Oct. 15	Oct. 25; s.s. "Port Melbourne"	6	12	Versailles and Bordeaux (one box).

* Delayed in post during transit from Paris to London; missed boat sailing on 20th October, for which consignment was intended; kept in cold store in London till 25th, when it left by s.s. "Port Melbourne."

EMERGENCE RECORDS FROM CONTROLS, OXFORD.

In addition to the foregoing, each month one control box of parasitized material was sent by M. Bru to the writer at the Imperial Forestry Institute, University of Oxford. On arrival in Oxford the controls were placed in parasite emergence cages, and records were kept of emergences from these, a summary of which follows :—

Consignment 1 (July, 1926).

The material in this control box was collected at Versailles on 7th July. Placed that evening in an ice-chest at the laboratory in Paris, it remained there until 10th July, when it was packed exactly as though for shipment to New Zealand, but was conveyed by the writer to his laboratory at Oxford on 12th July. Active *Platygaster* adults were observed in the orchards from which this control was gathered. The parasites noted in the field in the beginning of July were seen darting hither and thither from leaf to leaf on *Perrisia*-infested trees. As has been remarked by Dr. Myers and by Mr. Miller, the parasites showed greatest activity in bright sunshine.

The following emergences were noted from this control :—

End of July : A few adult *Perrisia*.

11th August : 8 dead *Perrisia* in tubes ; 3 parasites (*Platygaster* sp.)—very active.

18th August : 7 parasites (*Platygaster*).

21st August : 8 parasites (*Platygaster*).

14th September : No further parasites since 21st August ; 9 midges *not Perrisia*.

20th September : *Midges (*not Perrisia*) alive, 10 ; dead, 7.

25th September : 9 *Sciara* midges.

29th September : Swarms of *Sciara* midges. Midges of this species continued to appear until the middle of October.

No further *Perrisia* adults or parasites made their appearance in the emergence-tubes ; and no activity noted to date (25th February, 1927).

* Identified by Mr. P H. Grimshaw, of the Royal Scottish Museum, Edinburgh, as species of *Sciara* which live in decaying vegetable matter.

Consignment 2 (August).

Controls collected from Versailles on 18th August and placed in emergence-boxes at Oxford on 23rd August.

14th September: Midges present in tubes of *Perrisia* and *Sciara* spp. 1 parasite (chalcid) in tube.

21st September: *Sciara* midges, 10; *Perrisia* midges, 2. Mites of unknown species noted in tubes, and apparently feeding on dead midges.

25th September: *Perrisia*, 1; *Sciara* midges, swarms; parasites (*Platygaster*), 2.

4th October: Large numbers of *Sciara* midges still emerging. Parasites (*Platygaster* sp. ?) also in large numbers, but whether from *Sciara* or from *Perrisia* impossible to say.

12th October: Parasites, 3; *Sciara*, 18.

21st October: *Sciara*, 1.

No further activity to date (25th February, 1927).

Consignment 3 (September).

Controls collected at Angers on 15th September; despatched from Paris on 18th September; reached Oxford and there placed in parasite emergence-boxes on 20th.

12th October: *Perrisia* in tubes, 7. No further activity to date (25th February, 1927).

Consignment 4 (October).

Controls collected at Versailles during the second week of October. One box was sent from Bordeaux. The Versailles controls were despatched from Paris on 16th October, and were placed in parasite cages at Oxford on 20th.

No emergences of any sort were observed from this material to date (25th February, 1927).

CONCLUSIONS.

In summing up the results of the emergence records of the controls, it is interesting to note the large numbers, first, of *Sciara* midges which issued from the material in August and continued to appear throughout the summer, gradually falling off towards the end of September and the beginning of October. The appearance of these insects was followed by the emergence of large numbers of parasites, apparently of a *Platygaster* species. At the beginning of this period, however, some few adult *Perrisia* also were found in the emergence-tubes. The question at once arises whether these parasites came from the *Sciara* midge larvæ or from larvæ of *Perrisia*, or possibly from both. One is inclined to the opinion that they were parasites of the *Sciara* species, but it has not been possible to determine this. The parasites obtained from the different control boxes have not yet been named.

The presence of *Sciara* among the material is in itself of interest, and shows the possibility of large numbers of this insect, together with its parasites, being reared in New Zealand from the actual consignments of *Perrisia* sent from France. At first it was suspected that these midges might have come from the sphagnum moss used in the packing of the pear-leaves. It was ascertained, however, that according to instructions all the sphagnum moss used had been sterilized at a high temperature (120° C.) in an autoclave before packing. In this way all life present in the moss must have been destroyed. It appears, therefore, that the *Sciara* midges must have come from the pear-leaves themselves. On arrival in Oxford these were kept free from all source of contamination, and one could thus be certain that everything emerging from the parasite-boxes originated from the pear-leaves and had been present in them when collected in the orchards in France.

It is not surprising that these scavenger midges (*Sciara*) should be found in such material. Very frequently a pear-leaf containing *Perrisia* larvæ and severely attacked by them is quite black and decayed, and, possibly, would afford suitable breeding-ground for such an insect as a species of *Sciara*, which feeds on decaying vegetable matter.

One hoped that the best results would be obtained in New Zealand from the consignments sent out in August and September. The October consignment, sent out several weeks earlier than the corresponding despatch in 1925, was small; material was difficult to find, since the majority of the pear-leaves had fallen to the ground, carrying the wintering midge-larvæ with them. There was always the possibility, however, that these larvæ might contain just as many parasites as those of other consignments, and it was because of this that the collection in France was extended to include October.

No work was carried out during the summer in France on the biology of the parasites, nor a study made of the part they played in the control of the pear-leaf-rolling midge in Europe. All that was undertaken was a collection of larvæ in districts in which it was known from the work in 1925 that parasites were to be found.

It is with great interest that one follows the work of acclimatization, rearing, and breeding of the parasites obtained from these consignments, in New Zealand, by Mr. Miller. Such work must necessarily be conducted first of all on quite an experimental scale, in strictly enclosed insectaries in pear-midge-infested localities. One can never forecast the results of an attempt at biological control of any injurious insect, but one hopes that Mr. Miller's work will achieve every success, and that in time, when a complete knowledge has been obtained of the life-cycle of the parasites, and when hyperparasites, if any, have been eliminated, the introduced parasites will become so acclimatized and of such value that the ravages of *Perrisia pyri* in New Zealand may eventually be greatly reduced and this insect no longer be regarded as a serious pest.

APPRECIATION.

In conclusion, the writer wishes to thank Dr. Paul Marchal for so kindly granting, once again, facilities in his laboratory for work during the brief visit to Paris in July. Thanks are due to M. Trouvelot for his help and for arranging the collection of the July consignment, and to Dr. Feytaud for procuring material from Bordeaux in October. M. Pinelle very willingly granted permission again for collection to be carried out in the extensive orchards of the Ecole d'Horticulture at Versailles. Finally, special thanks are due to M. Bru for the efficient and careful manner with which he carried out the work during the whole season.

NOTE.—A report by Mr. Miller on the consignments of material described by Dr. Fisher, as received and dealt with in New Zealand, will be published in next month's *Journal*.—ED.

Foot-and-mouth Disease in England.—Cabling last month, the High Commissioner, London, advised an outbreak of foot-and-mouth at Tamworth, in Staffordshire. This was the first case since April last, and all movement restrictions had been withdrawn by the Ministry of Agriculture in May. A further cable from the High Commissioner, dated 4th August, advised four more outbreaks at Tamworth and three in Kent.

MANURING OF ORCHARD TREES.

EXPERIMENT WITH APPLES IN BLENHEIM DISTRICT.

M. DAVEY, Orchard Instructor, Blenheim.

SOME two years ago the Marlborough Fruitgrowers' Association, having arrived at the conviction that the time had come when it was impossible to produce profitable and maximum crops of apples without the aid of fertilizers, requested the Horticulture Division of the Department of Agriculture to conduct a local manurial experiment on behalf of the growers. The aim of the experiment was to determine the quantities and more particularly the proportions of nitrogenous, phosphatic, and potassic manures most suitable for the district, by which improvements such as renovation of debilitated trees and increased yields could be obtained.

The use of two orchards was secured, those chosen being the properties of Messrs. T. H. Torode and A. MacDonald, situated at Fairhall. These orchards were selected as being typical of the majority of those planted in the district—consisting of comparatively small trees in heavy bearing and declining in vigour, planted on light land with gravelly subsoil, and alternately carrying heavy and light crops. The trees experimented with were twelve years old and from 8 ft. to 10 ft. high.

The writer, acting in conjunction with Mr. Torode, carried out the experiment and noted results. The trees selected for the experiment were leading export varieties, as shown in the tabulated results. The varieties, which extended across the two orchards, were treated in blocks of fifteen, three trees wide and five trees deep in the rows. Owing to necessity there was one exception to the number of trees in the groups, only twelve trees of Rome Beauty being incorporated in the blocks of this variety.

In No. 1 experiment 5 lb. of manure per tree was used, and in No. 2 experiment 10 lb. per tree. Between these plots three rows of trees, five trees deep in the rows, received no manure, the centre row only being regarded as a check row for noting obvious results, while the yield was taken from all three rows. A special trial was made with two individual trees for purposes set out in Experiment No. 3. Details of the experiments and results are set out in the accompanying tables.

Application of the manures was made on 17th September, 1925, with the exception of the nitrate of soda, which was applied at the pink stage of blossom-development on 12th October. The general manures were surface-sown prior to ploughing, which was carried out one month later. Unfortunately, the growing season following the application of the manures was excessively dry, the rainfall for the six succeeding months being as follows: October, 2·63 in.; November, 0·57 in.; December, 0·74 in.; January, 1·73 in.; February, 2·63 in.; March, 3·32 in.—making a total of only 11·62 in. of rain over the whole of the period from which results could be expected. Owing to this adverse condition prevailing it was decided to allow the experiment

Experiment No. 1 : 5 lb. Manure to each Tree.

Variety treated and Number of Trees.	Manure applied to each Tree.	Yield in Bushels by Manured Trees.			Yield in Bushels by Unmanured Trees.			Remarks, 1926 Season.	Remarks, 1927 Season.
		1926.	1927.	Total.	1926.	1927.	Total.		
Ballarat Seedling (15)	4 lb. super .. .. ; ¾ lb. nitrate soda .. ; ½ lb. sulphate potash ..	28	24	52	17½	17¼	34¾	No increase in growth over unmanured area	90 per cent. fully developed fruit-buds on manured trees ; 60 per cent. only on unmanured. Second successive heavy crop.
Dunn's (15) ..	3 lb. super .. .. ; 1 lb. nitrate soda .. ; 1 lb. sulphate potash ..	17½	31	48½	12	24½	36½	Nitrate of soda in combination showed improved growth over same variety dressed with 10 lb. super (see No. 2 experiment)	Bud-formation promising heavy crop for 1928 season.
Rome Beauty (12)	3 lb. super .. .. ; 1 lb. sulphate ammonia ; 1 lb. sulphate potash ..	9	15½	24½	6½	9	15½	Trees much improved ; buds extra plump	Trees further improved ; foliage well retained in autumn ; extension of branches 6 in. to 10 in., compared with 2 in. on unmanured area.
Delicious (15) ..	3 lb. super .. .. ; 2 lb. dried blood ..	20	9	29	8	6	14	Trees much distressed by droughty conditions ; results could be estimated only by comparing increase in yield over unmanured area	Fruiting-wood highly developed on manured trees ; no increase in leaders. Fully developed fruit-buds throughout. Crop seriously depleted by late frost.
Dougherty (15)	3 lb. super .. .. ; 2 lb. sulphate potash ..	8	8	16	6¼	5¾	11¾	Trees receiving 10 lb. manure rather smaller trees than those receiving 5 lb., owing to nature of ground.	
Cox's Orange (15) ..	5 lb. super	8½	6	14½	6	2¼	8¼	No difference in general appearance of trees compared with unmanured area. Consider dry conditions nullified experiment	Bud-development more pronounced in manured area.
Sturmer (15)	5 lb. Nauru phosphate ..	16½	13½	30	12	9	21	Unmanured section foliage weak when compared with manured area	Extra development of foliage on manured area very pronounced during early summer.
Total yields ..	..	107½	107	214½	68½	73½	141¾		

Totals of 102 trees treated = approximately ¾ acre, at 134 trees to the acre.
Total increased yield from manured trees over unmanured, 73 bushels, equivalent to an increase of 91 bushels per acre.

Experiment No. 2: 10 lb. Manure to each Tree.

Variety treated and Number of Trees.	Manure applied to each Tree.	Yield in Bushels by Manured Trees.			Yield in Bushels by Unmanured Trees.			Remarks, 1926 Season.	Remarks, 1927 Season.
		1926.	1927.	Total.	1926.	1927.	Total.		
Ballarat Seedling (15) ..	10 lb. Nauru phosphate	22	13¾	35¾	17½	17½	34¾	..	Trees in both areas carrying maximum crop. Bud-development for 1928 season superior on manured area.
Dunn's (15)	10 lb. super	14	36	50	12	24½	36½	Good crop gathered from both manured and unmanured trees	Extremely heavy crop harvested; ¾ bushel below market size not gathered from each tree. Buds promise heavy crop 1928 season.
Rome Beauty (12)	8 lb. super .. .. / 1 lb. nitrate soda .. / 1 lb. sulphate potash ..	12	12¾	24¾	6½	9	15½	Heavy crop of small, badly developed fruit. Buds showing well for next season	Heavy crop of medium-sized highly-coloured fruit harvested. Substantial increase in fruiting-laterals.
Delicious (15) ..	6 lb. super .. .. / 4 lb. sulphate potash ..	12	14	26	8	6	14	..	Fair crop of well-coloured fruit harvested. Crop much reduced by late frost. Bud-development for 1928 season very good.
Dougherty (15)	6 lb. super .. .. / 2 lb. sulphate ammonia / 2 lb. sulphate potash ..	9	9½	18½	6½	5½	11¾	Foliage retained much later than usual	Fair crop gathered; trees showing less debility.
Cox's Orange (15)	6 lb. super .. .. / 4 lb. dried blood ..	14	8	22	6	2¾	8¾	..	Little extra extension of leaders; fruiting-wood greatly developed; red, impoverished appearance of bark disappearing in manured trees; better development of bud system.
Sturmer (15) ..	6 lb. super .. .. / 2 lb. nitrate soda .. / 2 lb. sulphate potash ..	17	16¾	33¾	12	9	21	No extension of leaders. Heavy crop harvested on all sections; fruit small	Leader growth developed 9 in. to 18 in. on most leaders in manured area only. Increase in size of fruit harvested, and buds fully developed for 1928 season.
Total yields ..	..	100	110½	210½	68½	73½	141¾		

Total 102 trees treated = ¾ acre, at 134 trees to the acre.
Total increased yield from manured trees over unmanured, 61 bushels, equivalent to approximately 80 bushels per acre.

Experiment No. 3 (Special).

Variety treated and Number of Trees.	Manure used.	Purpose of Experiment.	Results, 1926	Results, 1927.
Rome Beauty (1)	5 lb. nitrate soda	To stimulate growth in very debilitated and stagnant tree	Negative. Attributed to insufficient rainfall	Foliage renewed to dense condition; general extension of all growing terminals, also maximum development of fruit-buds for 1928 season.
Delicious (1) ..	5 lb. sulphate potash	To prevent or reduce heavy drop of fruit generally experienced in this variety, by increasing resistance to effects of spray, or hardening of plant-tissues; and to increase colour	Negative. Tree showing symptoms of potash poisoning; recovered normal condition or appearance in late autumn	Negative. Depletion of crop by late frosts on a par with other trees of this variety. No benefit could be attributed to manuring.

to remain and to look for more pronounced results at the end of the second season (1926-27). Where remarks are made in tabulated form the results have been regarded as outstanding and conclusive.

SUMMARY.

(1) Where manures have been applied the total increases in yield show that manuring in almost every proportion would assure a profitable increase over expenditure compared with no manure.

(2) Nitrate of soda, used at 5 lb. to the individual tree, afforded the only instance in which both the results looked for were attained —namely, renewal of young growing terminals combined with increase in crop, thus making its continued use appear the most desirable application.

(3) Fruiting-wood and bud-development were considerably increased in every instance, probably due to prolonged retention of foliage in the autumn.

(4) A successive heavy crop was secured in the Sturmer trees with both formulas used, a feature which had not been previously attained in the history of the orchard.

(5) The increased quantities of fertilizers used in Experiment No. 2 do not seem justified by results.

(6) The results suggest that greater contrasts in quantities and proportions of manures would show more pronounced and more valuable results in future experiments which may be undertaken by growers for a similar purpose.

The thanks of the Department are due to Mr. T. H. Torode for his close co-operation and trouble taken in recording the weight of crops harvested from the trees under test. The manures for the experiment were generously donated by Messrs. Wright, Stephenson, and Co., Ltd., on their being approached by the fruitgrowers.

WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

NOTES ON OPERATIONS, SEASON 1926–27.

R. M. McGillivray, F.L.S., Instructor in Agriculture, Invercargill.

During the year under review the Winton Experimental Area was vested in the Winton Agricultural and Pastoral Association, and the management taken over by a committee, of which the writer is *ex officio* chairman. The name of the establishment was at the same time altered as shown in the title above.

The farm has had a very successful year, and it is pleasing to be able to record a most satisfactory attendance of farmers throughout the period. As usual, the pasture blocks and their treatment were the principal pivot of attraction. The manurial trials of swedes, chou moellier, &c., attracted the attention of many, as also did the growing of smother-crops for checking Californian thistle.

During the period a dwellinghouse for the Overseer was erected, and the farm buildings were shifted to a more convenient site. The plans for a cow-byre are now in hand, and it is proposed to establish a dairy herd in the coming spring and to go fully into the dairying position, including the possibilities of stall-feeding during the winter and early spring. Such an investigation would be of great importance, and its outcome should have an important bearing on future dairying practice in Southland.

PASTURE INVESTIGATIONS.

Block 1, sown in October, 1925, is a pasture in which meadow-fescue took the place of perennial rye-grass. There are three separate subdivisions, in which the fescue was included in the mixture at the rate of 8 lb., 16 lb., and 24 lb. per acre respectively. This pasture has proved a great success. The mixture in which the fescue was included at the rate of 16 lb. per acre appears to be better than the sowings of 8 lb. and 24 lb. Cocksfoot sown at the rate of 8 lb. per acre has established extremely well. Top-dressing was carried out in alternate strips of high-grade super and Seychelles guano, at the rate of 3 cwt. per acre. The super plots were slightly earlier in growth, but by the middle of November all plots were even, and the clover-plants were making a strong growth under both treatments. In the late autumn the Seychelles plots were to some extent closer eaten than were those where super had been applied.

In Block 2, laid down at the same time as Block 1, meadow-fescue was not included, its place in the mixture being taken by perennial rye-grass sown in three subdivisions at the rate of 8 lb., 16 lb., and 24 lb. per acre. At the present time the 24 lb. subdivision is slightly better than the other two. Cocksfoot was included in the mixture at the rate of 8 lb. per acre, but its establishment when in competition with perennial rye-grass has been slow. The depressing effect of rye-grass on cocksfoot-establishment under certain conditions is well known, and this is a striking demonstration of the fact. This pasture is quite a good one, with rye-grass easily dominant even where only 8 lb. per

acre of it was sown. The top-dressing was the same as that recorded for Block 1, and results were also similar.

Block 3: A special report on this area was published in the *Journal* for March last under the title of "Liming and Top-dressing of Pasture at Winton Experimental Farm: Results for 1926."

Block 4 was laid down in 1920, and has been top-dressed with basic slag since 1924. The pasture is in extremely good heart, and is becoming widely known owing to its flourishing condition and high carrying-capacity. It is a pasture that has successfully carried stud hoggets through the past three winters without the aid of turnips or other feed. All pasture-plants sown in 1920 are still to be found, with the exception of Lotus major, which seems to have been crowded out.

Block 6 is a perennial rye-grass and white clover pasture sown in 1920. It was top-dressed in 1924 with Nauru rock phosphate, but without apparent results. In the autumn of 1926 it was noticed that the turf was opening up and failing badly. One half was therefore top-dressed with high-grade super and the other half with basic slag. The improvement in condition shown in the spring of 1926 was very remarkable. In the case of both fertilizers the pasture constituents made a fresh growth and clover appeared in abundance. Two acres of this block also received 30 per cent. potash salts, at 1 cwt. per acre, across both the super and slag plots. An earlier growth of clover was apparent in the spring, also a more prolific clover-growth in the late autumn, but no marked preference for the potash area was shown by the sheep.

Part of the old brown-top pasture on Block 15 was top-dressed with carbonate of lime, 1 ton, and superphosphate, 3 cwt., per acre in June, 1925, in order to obtain information as to results possible on such a sward, which, so far as could be seen, consisted only of brown-top and catsear. Very little difference was seen until about October, 1926, when white clover began to show up all over the top-dressed portion. It was also noticed that the stock grazed the top-dressed portion closely, and right up till May it provided good pasturage that was kept well eaten down.

Two other permanent-pasture blocks were laid down in October last, and are doing well. In one block an unlimed strip of land runs right across the field, and this affords a striking demonstration of the value of lime in Southland. On each side the pasture is strong and healthy, while on the unlimed strip it is weak, and weeds such as sorrel and spurrey are present in abundance.

At the Winton Farm top-dressing, harrowing, and mowing are regarded as vital operations in pasture management. The harrowing of pasture blocks is undertaken whenever necessary. Chain harrows are used for distributing the animal-droppings, but these are not drastic enough when it comes to work such as the renovation of old turf. No operation, however, is of more importance than mowing, and much of the success of the farm pastures can be attributed to the fact that rank growth is prevented.

SMOTHER-CROPPING FOR CALIFORNIAN THISTLE.

A field in which Californian thistles had a very strong hold was taken in hand in the autumn of 1926 and ploughed and sown, one part

in oats and winter vetches and the other in oats and *Lathyrus tingitanus*, for the purpose of acting as a smother-crop. The crop was sown in March, and came away so well that it had to be eaten off with sheep in May, and again in August and September. It was then allowed to stand for a seed crop. The winter vetches made a very heavy growth, but not to be compared in weight to that of the *Lathyrus*, which brought about a complete smother of the thistle. Very few thistles appeared, even in the portion sown in vetches. On examination it was found that the underground stems had a shrunken appearance and were less than one-third of their normal size.

FIG. 1. FIELD BADLY INFESTED WITH CALIFORNIAN THISTLE PRIOR TO GROWING OF SMOTHER-CROPS.

The field has again been sown in oats and vetches in an endeavour to completely clear the area of thistle during the coming season. Another area of 5 acres has been sown in *Lathyrus tingitanus*, so that a supply of seed of this vigorous-growing legume may be obtained for future operations.

CHOU MOELLIER, THOUSAND HEADED KALE, AND CRIMSON KING SWEDES.

An area of 10 acres (Block 13) was devoted to manurial tests of chou moellier, thousand-headed kale, and Crimson King swedes. An additional acre was also sown in swedes, the seed for half of which was treated by M. J. C. Neill, Field Mycologist, in connection with the control of dry-rot. The bulbs were examined on the last day of April. Considerable infection was found in the untreated-seed area, but only one bulb was found infected on the plot sown with treated seed. Moreover, this infected one was found in the drill next the untreated seed and in close proximity to a patch of dry-rotted bulbs.

The manurial trial, which proved of special interest to many visitors, was laid out as follows, all amounts being at per-acre rate: (1) Super, 2 cwt.; (2) super, 2 cwt., and blood, 1 cwt.; (3) super, 2 cwt., and 30-per-cent. potash, 1 cwt.; (4) super, 2 cwt., 30-per-cent. potash, 1 cwt., and blood, 1 cwt.

Results from the different treatments were as follows, the figures given representing yield per acre: Chou moellier—(1) 20·0 tons, (2) 19·3 tons, (3) 20·7 tons, (4) 22·0 tons; thousand-headed kale—(1) 14·6 tons, (2) 12·5 tons, (3) 16·3 tons, (4) 12·2 tons; swedes—(1) 31·5 tons, (2) 33·2 tons, (3) 35·6 tons, (4) 31·8 tons.

FIG. 2. SHEEP ON SWEDE TRIAL CROP.

SWEDE MANURIAL TRIAL.

A 5-acre manurial trial of swedes proved of considerable interest. The fertilizers were tested at the rate of 2 cwt. and 2½ cwt. per acre. In the case of the mixtures, half-and-half of each fertilizer was used. Results are shown in the following table:—

Fertilizer.	Yield per Acre.		Increase in Yield per Acre.
	Fertilizer, 2½ Cwt.	Fertilizer, 2 Cwt.	
	Tons.	Tons.	Tons.
Superphosphate	35·23	27·27	7·96
Super and Walpole Island phosphate	33·26	31·15	2·11
Super and basic slag	42·68	36·43	6·25
Super	39·50	27·73	11·77
Super and Seychelles phosphate	41·95	32·43	9·52
Super and Ephos phosphate	42·76	40·31	2·45
Super	39·15	24·88	14·27
Super and Nauru phosphate	38·49	33·60	4·89

Mr. T. Pattinson, Manager of the farm, carried out his work in a most efficient manner, and much of the year's success is due to his care and close attention to details.

PACKING OF PEARS FOR EXPORT.

J. A. CAMPBELL, Director of the Horticulture Division, Wellington.

ALTHOUGH up to the present pears have not been exported from New Zealand in quantities comparable with apples, even relatively to the amount produced, sufficient has been done in this respect to demonstrate two important facts. The first is that under normal conditions pears—particularly the better-class varieties arriving on the English market in a sound condition—can be practically relied upon to return to the shipper a very satisfactory profit. The second is that, generally speaking, we shall have to exercise very much greater care before we can hope to land the major portion of our shipments not in indifferent to passable order, but in that really good condition in which they are required by the market and which the excellence of our fruit fully warrants.

During the past eight years pears have been exported from New Zealand in the following quantities :—

	Crates.		Crates.
1920 ..	1,009	1924 ..	1,432
1921 ..	3,112	1925 ..	3,516
1922 ..	8,148	1926 ..	9,449
1923 ..	313	1927 ..	22,075

The past season's shipments were the largest that have yet gone forward, and although the class of fruit shipped was of high quality, embracing the leading varieties, and secured to shippers really good average returns, we by no means escaped criticism from the London end. Some of this criticism was extremely caustic, and rightly so, if alleged shortcomings really existed, such as extremely loose packing, entire absence of wood-wool, stem-punctures, rot, &c. Unflattering comparisons were made between our methods of handling pears and those employed by South African growers, or in comparison with our own handling of apples. Why at this stage we should be so much at fault is difficult to understand.

The success achieved by South Africa has been fully appreciated. That country is much nearer to the British market than is New Zealand; nevertheless, growers there find it expedient in their own interests to exercise the greatest care possible in the handling and packing of their pears—a care far greater than is observed in this country in relation to a service infinitely more trying to the fruit. As much information as possible relative to the methods employed in South Africa has been secured and made available to New Zealand pear-growers. Even used South African pear-trays have been secured from England, and trays fashioned on the same plan made available for use here. Therefore, as far as the package is concerned, we are as well situated as South Africa. The trouble, however, lies in the fact that we are not putting the package and the wood-wool packing used in connection with it to the same intelligent use as the South Africans, nor are we handling our fruit as carefully.

Each pear-grower should secure a supply of timber that will enable him to construct trays $2\frac{1}{2}$ in., $2\frac{3}{4}$ in., or 3 in. deep, or to arrange

for all trays to be 2½ in. deep, and at the same time have a supply of cleats similar to those used on the lids of apple-cases. By placing one or more of such cleats under either end of the lid the tray can be made to accommodate fruit of different sizes.

Whether timber for the construction of trays of different depths is ordered, or whether cleats are to be used for increasing the depth of trays, is a matter for the individual grower to decide; but it is essential that the tray should accommodate the pear with something over ¼ in. to spare, so as to allow for an adequate cushion of wood-wool. In the latter connection, again, our methods are faulty as compared with those of our friends of South Africa. We certainly use wood-wool—at least, we are supposed to do so. Nevertheless, reports to hand from London regarding the pears forwarded by the "Ionic" in the past season state that, in some instances at least, the pears were resting on the bare board, not a vestige of packing-material being present. Notwithstanding this charge, wood-wool is generally used, but more often than not in such quantities as to be practically useless for the purpose intended—namely, to tighten the pack and provide an adequate protective cushion for the fruit. South African growers are evidently more lavish in the use of this material, going to the extent of providing practically a padded pocket for each pear—and why should they not? It is surely a short-sighted policy on the part of a grower who has gone to the trouble and expense of preparing a comparatively costly package, and has placed in that package fruit of first-class quality, which, if in good condition when offered for sale, is likely to realize a handsome price, to jeopardize the whole position in endeavouring to economize in such an inexpensive material as wood-wool.

There is also the question of handling. The examination of pear consignments at Wellington before shipment, supported by reports from London, indicates that the item of stem-punctures plays a very important part in the condition of the fruit. It is essential that growers should realize this, and do everything possible by way of careful handling to guard against the trouble in future.

Pears are put up in what may be termed fancy packages, each tray being complete in itself and containing one layer of fruit only. The buyer, in view of the get-up, small quantity of fruit, and price, is justified in expecting something specially good, and it is easy to understand his dissatisfaction when he finds that several rotten pears form part of the limited number the tray originally contained. On the other hand, if this were evident before the purchase was made, the reduction in price would no doubt represent a fairly heavy penalty on the grower for his carelessness.

POINTS SUMMARIZED.

Summarized, the points to be observed in connection with the export of pears are as follows:—

(1) Select only good-quality pears of the popular varieties that will carry well.

(2) Pick and handle the fruit carefully, remembering that a high-priced article is being dealt with.

(3) Provide trays that will comfortably accommodate the fruit of different sizes, allowing room for an adequate amount of wood-wool

packing. Do not attempt to pack large pears in shallow trays, or try to make small pears fit a deep tray by packing them on their ends. Packs of the latter kind invariably loosen up and rattle.

(4) Size the fruit carefully, packing only pears of the same size in each tray forming the package.

(5) Pack all pears on their sides, avoiding overlapping as much as possible. Fill all vacant spaces with wood-wool, place a good layer over the fruit, and press down firmly to consolidate it before lidding.

Full particulars regarding the construction of trays, building up of packages, wiring, labelling, and marking were given in the 1927 season's export regulations published in the *Journal* for January last.

WAX COATING OF EXPORT CHEESE.

SOME FURTHER INFORMATION.

W. E. Gwillim, Assistant Director of the Dairy Division, Wellington.

Several prominent dairy companies in the past season have adopted the method of coating their export cheese with paraffin-wax. The object apparently was to serve the double purpose of meeting the requirements of those buyers who prefer wax-coated cheese, and to save a certain amount of the loss in weight from shrinkage that occurs with cheese in general. Specially designed plant has been installed at the factories, which enables the waxing to be applied expeditiously and with very little extra labour. The enterprise is commendable, and has aroused considerable interest among cheesemakers.

It may be recalled that the subject of wax-coating cheese was discussed in the *Journal* for January, 1925. The merits and limitations of the method were pointed out, and the results given of some experiments carried out by the Dairy Division. These may be summarized as follows: (1) Only a section of the trade favoured wax coating; (2) wax-coated cheese matured better than unwaxed; (3) the appearance of the cheese was more pleasing in so far as there was less mould-growth; and (4) the saving in weight effected by wax coating was about 1 per cent. between here and arrival of the cheese in Britain. It has since been observed that wax coating affords cheese extra protection against dampness due to condensation of moisture in the air circulated in the cool chambers of ships during the voyage to the overseas market.

According to reports received from our officers in Britain regarding the shipments of wax-coated cheese received this season, the cheese arrived in good condition and occasioned no adverse comments from the selling-agents. The wax had been well applied, except that in a few of the earlier shipments the coating was a little thicker than desirable. Buyers generally displayed no special interest in regard to the coating, the large majority appearing indifferent as to whether the cheese were waxed or not, and it is thought that much was sold without the buyers noticing the wax coating.

Inquiry of merchants handling the cheese as to the advantages likely to accrue to the producer by general adoption of the method

elicited information to the effect that the absence of wax coating was not a selling-point against New Zealand cheese—in fact, a large number of the trade prefer New Zealand cheese in its usual unwaxed condition; also, that there is some prejudice against wax-coated cheese. It was considered that the only gain which could be safely counted upon would be the saving effected in shrinkage during the transit of the cheese from New Zealand. This view was based on experience in the storage of Canadian cheese, which had demonstrated that the wax-coated article lost less in weight than the unwaxed. Each season it is usual to hold a certain quantity of Canadian cheese for several months for maturing purposes. The cheese selected is of good-keeping quality, and is waxed in Canada to the order of the buyer. The consensus of opinion was that as New Zealand cheese is usually sold promptly after arrival the necessity for wax coating, from the seller's point of view, does not arise.

It may be concluded from what our officers have reported that the general adoption of wax coating would be inadvisable, but in cases where the selling-agent or buyer desires wax-coated cheese for his trade the method is worth undertaking. In any case, wax should not be applied to other than well-made, good-bodied cheese.

PRODUCTION PER CAPITA IN THE DAIRY INDUSTRY.

"MEMBERS of the conference may be interested in an indication of the production, on a *per capita* basis, of those persons engaged on farms principally devoted to dairying," remarked Mr. W. M. Singleton at the recent annual conference of the National Dairy Association. "Converting the whole of our dairy-products to the basis of butterfat equivalent, the figures show that the production of butterfat per person so employed was as follows:—

Year.	Butterfat.	Percentage Increase over 1920–21.	Year.	Butterfat.	Percentage Increase over 1920–21.
	lb.			lb.	
1920–21 ..	2,513	..	1923–24 ..	2,853	13·50
1921–22 ..	2,789	10·96	1924–25 ..	2,997	19·24
1922–23 ..	2,761	9·84	1925–26 ..	3,228	22·12

"These figures suggest that there is no general disposition among the people engaged in the production of milk and cream to follow the 'ca' canny' or 'go-slow' policy. The increase *per capita* has doubtless been favourably influenced by the extension of milking by machinery. It has also been similarly influenced by the improvement in yield of the average dairy cow.

"The following figures, relating to the manufacturing phase, show an increasing output per employee in dairy factories:—

Year.	*Per Capita* Output of Butterfat.	Percentage Increase over 1920–21.	Year.	*Per Capita* Output of Butterfat.	Percentage Increase over 1920–21.
	lb.			lb.	
1920–21 ..	45,736	..	1923–24 ..	56,044	22·5
1921–22 ..	51,466	12·5	1924–25 ..	58,094	27·0
1922–23 ..	56,831	24·2	1925–26 ..	63,991	39·9

SEASONAL NOTES.

THE FARM.

FEEDING OF LIVE-STOCK.

SEPTEMBER is frequently a particularly difficult month for the grass-farmer. If the weather is cold the spring growth of grass may be greatly delayed, and early-calved cows and newly-lambed ewes may do badly for want of proper feed. The provision of supplementary feed and the management of grassland, so that normally sufficient feed is available for the early spring, is an extremely important factor in successful grass-farming. The methods for attaining this end will naturally vary considerably in different localities and with the system of farm-management adopted.

In North Island dairying districts the modern tendency in grass-farming is in the direction of close subdivision, heavy top-dressing, and the provision of supplementary feed for periods of grass shortage by means of hay and ensilage saved from the surplus summer production of grass. Cows in milk require feed rich in protein — *i.e.*, having generally a narrow nutritive ratio—such as young pasture-grass. In order to provide sufficient protein-rich feed for the early spring it is usually necessary to save a considerable amount of the winter growth of grass, by almost completely maintaining the cows during their dry period on hay, ensilage, and roots. Grass can be most successfully saved for the spring when the pastures are top dressed in the early winter and consist very largely of perennial rye-grass.

However, it frequently happens that when the grass-growth is late any grass that has been saved during the winter is finished before the spring growth starts, and consequently production falls in September. To provide against this it is always wise to keep the best hay available for spring feeding. Lucerne or clover hay is admirable for milk-production; but even where these are not available the best pasture hay containing the most clover should be kept for the spring. When grass is scarce, and heavy pasture hay, ensilage, and root feeding is being given to milking-cows in September, it might possibly be profitable, in certain cases, to feed protein-rich concentrates to the cows until grass-growth starts properly.

For the mixed farmer raising fat lambs two courses are open to provide for feed shortages in the early spring—the provision of grass supplementary crops and the regulation of stocking. On South Island mixed arable farms fodder crops figure largely in the cropping system, and in normal years the breeding-flock is carried through the winter on turnips and green cereals until the spring growth of grass commences. Although, owing to the low winter temperatures, there is little winter grass-growth from permanent pasture that can be made available for early spring grazing, the careful spelling of all new short-rotation and temporary pastures usually conserves sufficient feed in years when the ordinary grass-growth is delayed.

On North and South Island permanent-grass farms where fat-lamb raising is an important industry the secret of success lies generally in understocking during the winter with breeding-ewes, and in the

later regulation of stocking with dry cattle or sheep, depending on the grass-growth. On many North Island fat-lamb-raising grass-farms the rearing of dairy heifers is becoming an important industry, and this class of cattle allows of better stock manipulation than the buying-in of dry sheep or cattle for short periods. Bought in as calves, wintered, mated with a dairy bull, and sold later the following winter as in-calf heifers, they can be profitably used to keep the pastures short for the ewes and lambs, and also repay the feeding of hay in the winter. In this way some of the surplus summer grass can be profitably used for winter feeding, and this allows more grass to be available for the breeding-ewes in the winter and early spring.

CROP-PRODUCTION.

Land for root and forage crops will normally be ploughed in September, after the sowing of spring cereals is finished. In the drier districts, when such crops follow a cereal, winter ploughing is preferable so as to allow easy penetration of the winter rains. Ploughing in September will usually be the case when grassland is broken up, or where roots follow a green-feed cereal crop sown on a stubble. In the case of grassland the skim-coulter could be more often used in ploughing than it is at present. Its use allows of the formation of a firm seed-bed, and if wet weather follows ploughing, preventing working of the land, there is little or no grass-growth between the furrow slices. Such grass-growth is particularly noticeable in many parts of the North Island, and is often extremely troublesome when the ground is being worked down.

Land for potatoes that has been skimmed in the autumn should be cross-ploughed in readiness for working up and planting in October.

As the autumn-sown cereals are fed off they should be harrowed, so as to aerate the surface and scatter the clods which have been broken up by the winter frosts.

Except in the far South, all spring cereals and cereal and legume mixtures for hay should be got in by the end of August. If heavy rains are likely in September it is often worth while to delay the sowing of barley till the end of that month or early October in order to avoid the danger of having the crop drowned out.

Cereals sown in the spring require a heavier seeding than when sown in the autumn, because, when autumn-sown, tillering takes place to a greater extent than is the case with spring crops. Also with cereals for threshing, a light seeding in the spring will give rise to a number of late tillers, and consequently a high proportion of shrivelled grain. The average seeding for spring cereals will be about 2½ bushels to the acre, but the amount will vary from 2 to 3 bushels, depending on the cereal and the local conditions. Oats and tares are often used as a hay crop in arable-farming districts, and can be depended on to give a heavy yield of very nutritious hay. The average seeding is about 2 bushels of Algerian oats and 1 bushel of tares.

PASTURE-MANAGEMENT.

All dairying pastures will benefit from thorough chain and tripod harrowing during September. Especially is this the case with pastures on which winter supplementary feeding has been carried out.

The organic matter of the spread droppings has a wonderfully stimulating effect on both clovers and grasses, and frequent chain-harrowing is essential for the maintenance of a good even turf. In harrowing old pastures it is not sufficient to spread the droppings only; the tripods should be heavy enough to slightly tear the surface and allow the aeration of the surface layer of the soil.

All spring top-dressing should be finished by the end of September. Superphosphate is the most suitable fertilizer to apply at this period of the year. Although top-dressing is now quite general in the North Island, there is no doubt that increased production could be obtained on many farms by a more extensive use of phosphatic fertilizers. It is very difficult to estimate the actual increase in production brought about by top-dressing, because other factors, such as closer subdivision and better live-stock, have practically always been closely associated with any progressive movement in agriculture in any given district. Top-dressing, however, was one of the chief means by which much of the Waikato land was raised in fertility, and it is interesting to consider the following figures relating to the agriculture of Waikato County covering a period of twenty years. In 1905 top-dressing was just beginning to be a recognized practice, while in 1925 the practice was general.

		1905.	1925.
Horses	(Number)	4,000	5,750
Dairy cows	,,	8,750	42,300
Other cattle	,,	17,000	32,750
Sheep	,,	28,000	43,750
Cereals	(Acres)	3,300	1,100
Fodder crops	,,	8,300	8,000
Sown grass	,,	107,250	173,250

In 1905 the carrying-capacity of the grassland was slightly over the equivalent of 1½ sheep per acre, and in 1925 it was equivalent to 3 sheep per acre. As will be seen, this increase in stocking was not accompanied by a proportionate increase in fodder crops; although the area under grass was nearly 75 per cent. greater in 1925, the area under supplementary crops had declined slightly.

—P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.

THE ORCHARD.

SPRING PREPARATIONS.

By the time these notes appear all pruning operations in the orchard should have been completed. If not, it is advisable to push on with the work as quickly as possible, giving time for a general clean-up before the trees start into growth for the coming season and spraying operations commence. Growers usually find themselves pushed for time at this season, probably on account of wet weather, &c., and consequently something is left undone. It may be that the prunings are left scattered about the orchard instead of being collected and burnt, or that the spray-pump has not received the necessary overhaul in preparation for its continual use during the spring and summer months. Nothing

is better calculated to test the temper of a grower than a spraying outfit continually going wrong, or, when cultivating the orchard, to be always stopping the implements to remove large prunings left lying about. Consequently it is well to be on time with all the routine work, and even if slightly before time there are always plenty of odd jobs to keep one fully occupied.

SPRAYING OPERATIONS.

It is recognized by all commercial orchardists that the early sprays up to the blossoming-period are of vital importance for the control of fungoid diseases, and although there is a tendency in some districts to delay the first spray as late as possible this practice is not recommended—anyhow until such time as we have positive proof that the early or green-tip spray is of no value and can be dispensed with. Spores of fungus diseases as well as insect pests are lurking under bud scales, rough bark, dead twigs, &c., and are only awaiting a favourable opportunity to commence their activities. Fruit-trees at this time of the year can stand a much stronger spray than later, therefore a good application early, when the trees are just starting into growth, often prevents trouble as the season advances.

Just when to start spraying must be determined by the orchardists in the different districts, there being, of course, variations from Auckland to Bluff. The most important point is to be ready with all appliances in good order, so that no time is lost when spraying actually commences. Thoroughness is the keynote to success, and every care should be taken that all exposed surfaces are covered with the spray, since any portion missed may mean an open port of entry for disease. Many growers, knowing that spraying is a more or less disagreeable job, are apt to rush the work, and they then sometimes wonder why the results are not as good as those of the next-door neighbour who sprayed with the same mixture at the same strength. Rather aim at spraying 5 acres per day properly than 10 acres just to get the work over. Weather conditions also play an important part in spraying operations. Should rain follow directly after spraying, it is advisable to repeat the operation, the main object being to keep a thin film of spray over every part of the tree.

Spraying programmes vary with the different districts and according to climatic conditions; consequently it is almost impossible to lay down any hard-and-fast rule suitable for the whole. If a grower has been successful in previous seasons with a certain programme he may be advised to adhere to it. On the other hand, if he is not getting the results desired the advice of the Orchard Instructor for the district should be sought.

The use of red oil at the dormant or bud-movement period is a very debatable point with growers, many claiming that the results obtained do not justify the use of such an expensive spray every season. However this may be, there is no doubt that it is a very beneficial spray, both for keeping insect pests in check and for the general good of the tree. Consequently it should be used at least periodically, at strength 1--15–25, according to advancement of the buds.

Many growers prefer a good bordeaux spray at the green-tip stage, especially on varieties such as Delicious and Sturmer. As there is

no fear of russeting at this period, bordeaux at strength 6–4–50 can be used with safety. If lime-sulphur is preferred, 1–20 to 1–25 at the same period should be used. Owing to the chance of russeting with bordeaux it is advisable to switch over to lime-sulphur after the first spray, using a 1–40 solution at the open-cluster period.

Bordeaux is recommended for the control of black-spot on pears—an application of 6–4 50 at the green-tip stage, followed by 3–4 50 from the open-cluster to the pink period. An exception may be made with the Winter Cole, P. Barry, and Josephine varieties, using 1–60 lime-sulphur at the pink stage in preference to bordeaux.

For the control of leaf-curl, shot-hole, &c., on stone-fruits a thorough application of bordeaux at strength 6–4–50 when the buds begin to swell is recommended. This should be followed by either bordeaux, 3–4–40, or lime-sulphur, 1–50, at the pink stage. It is claimed by many that lime-sulphur at the pink stage is a great factor in the control of brown-rot, and consequently it should not be neglected, as this disease probably takes more toll than any other trouble stone-fruits are subject to.

CULTIVATION.

Early cultivation of the orchard is as necessary and valuable as the early spraying, and if the annual ploughing has not already been done it is advisable to attend to it as soon as the soil is in a fit condition. Where late autumn ploughing was done, with the intention of cross-ploughing in the spring, the operation may be deferred for a short time, but it is essential that the work should be completed before the trees start into growth and spraying operations commence. Cultivation round the trees, where it is impossible to work with the plough, is sadly neglected in many orchards. Trees dug or hoed round at this time of the year, turning under all sods left by the plough, dead leaves, rubbish, &c., will require very little further attention during the season, as the disks or harrows will keep the soil fairly clean. Turn in cover-crops about this time, giving the green material every chance to rot before the dry weather sets in.

MANURING.

It is only during the past few seasons that systematic manuring has been carried out in many orchards. Growers are realizing that it is impossible to get the best crops every season without returning to the soil plant-food taken out during the growing-period of the tree. Probably the latter part of August or the beginning of September is the best time to apply manure in the orchard, this allowing the rains at that period to take it down into the soil. Each orchardist should find out what are the requirements of his orchard as far as manure is concerned, and apply it accordingly. By the growth of the tree, leaf-surface, fruitfulness, &c., a good idea can be formed as to whether phosphates, nitrogen, or potash is needed. Liming is also usually a beneficial adjunct to manure, and the application of 1 ton per acre every few seasons should not only tend to improve the soil, but make available much plant-food lying dormant.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

Planting.—Where new citrus plantations are being set out or replacements made in existing areas, planting should be done during August and September. It is true that citrus-trees may be transplanted up to late October, but much better establishment is secured by planting in early spring. The main essential factors of planting are that the soil shall be in good condition to work freely—not sticky. Trees should be planted firmly with the roots well spread, rather than in the hard, compacted, balled condition in which they are often received. Though the soil must be firmed round the roots, the surface soil should be left loose. The plants should be supported by a strong stake—inclined towards the prevailing wind—if the situation is at all exposed. The stake—not the tree—should be bound with sacking or like material to prevent chafe. Long, extended, or unshapely growth should be cut back so as to shape the tree and restore balance between top and roots. Any manures or fertilizers applied to the land at planting-time should be well mixed with the soil, not placed in direct contact with the roots. Plants with a stem of 12 in. to 15 in. are to be preferred, having the union of variety with stock about 6 in. above soil-level. All trees of low-branching habit should be pruned to a single stem, rather than allow the first branches to form near the ground. Varieties recommended for planting in this country are as follows :—

Lemons—Eureka and Lisbon.
Limes—Tahiti.
Sweet Oranges—Navelencia and Valencia Late.
Preserving Oranges—Poorman.
Mandarins—Scarlet and Thorny.
Pomelo—Marsh Seedless.

Pruning.—This season of the year, just prior to spring growth, is an appropriate time for generally shaping the tree by cutting back extended bare wood, undesirable wood, and all misplaced inside wood. All cuts made should be to a good bud, and the cut surface painted with coal-tar.

Cultivation.—Ploughing should be done to turn in green crops which may have been grown for this purpose, or weeds which are best disposed of at this period by being turned under. Even though the soil may be in clean condition, ploughing at this time of the year is beneficial, breaking up the compacted state of the soil and permitting aeration. The area near the trees which cannot be ploughed or cultivated with horse-implements should be dug with the spade, in order that the ground may be dealt with by the hoe later. Unless the land is dug over now fibrous roots become so dense as to make it impossible to more than scratch the surface later. On the other hand, by digging the soil now, when fibrous roots are least necessary, an open soil condition is secured which allows several inches of surface soil to be kept in good tilth during the summer. When ploughing to work in a heavy dressing of animal manure, it is better that the manure should be spread along the furrows as ploughing is being done. Where artificial fertilizers are to be used they should be spread evenly over the whole area, rather than immediately near the trees ; they may be ploughed in or worked in with the first cultivation. For bearing trees 4 lb. blood-and-bone, 1 lb. superphosphate, and ½ lb. sulphate of potash per tree is a good dressing now, with two dressings of ¼ lb. nitrate of

soda each later in the growing season. Half these quantities should suffice for trees up to five years old, while a proportionately heavier dressing should be given to very old or heavy-fruiting trees.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

THE SITTING HEN.

WHEN hens are used for hatching purposes the aim should be to make the conditions as natural as possible, at the same time having the hen under control. It is always best to have a boarded floor to a coop, unless, of course, the coop is under cover. In the latter case the nest should be made on the ground. When a coop in the open is used—whether with or without a floor—it should be raised inside with fine earth about 3 in. above ground-level. This will help to keep the hen and her brood high and dry when wet-weather conditions prevail. The nest should be formed in the earth in saucer shape, and made in such a way that the eggs will not roll out, nor roll on top of each other. The bottom should be more or less flat, in order to allow the hen the necessary room to turn the eggs, which she does several times a day.

Nothing but a little hay should come between the eggs and the earth, and if there is some moisture in the earth so much the better. The common trouble, when the natural mother is being used, of chicks failing to hatch when fully developed is invariably due to want of moisture, especially during the hot season of the year. In an endeavour to overcome this trouble some people spray the eggs with warm water towards the end of the incubation period, but this does not always have the desired effect. A better plan when it is considered that the air is dried down too far is to lift the hay, or whatever nesting-material is used, and slightly moisten the earth. In this way the heat of the bird's body will draw the moisture to the eggs, and soften the membrane under the shell, thereby greatly assisting the chick to get out of its shell.

Do not let lice drive the sitting hen from her nest—a common occurrence when the eggs are on the point of pipping. Give the hen a good dusting with insect-powder when being set, and again before the chicks hatch, care being taken that the powder reaches the skin. On no account dust the hen just before the hatching-period, or when the chicks are very young, as the powder is apt to get into the chicks' eyes and cause blindness.

It is a mistake to interfere with the hen when the chicks are hatching; remember that she is past the experimental stage and can manage best by herself. It is always a mistake to give a hen with a young brood a free range, as there is always the risk of the chicks being taken by cats. Besides, the grass may be long and wet, and this is apt to have an injurious effect on the little birds.

A hen should never be set on valuable eggs at the first sign of broodiness. The best plan is to try her first on some dummy eggs. Many valuable sittings of eggs have been scratched about and broken through their being placed under hens which did not at the time possess the right sitting desire. After five or six days the eggs should be examined by means of a tester, and any which are infertile or contain dead germs should be removed.

LITTER.

A correspondent desires to know the cause of the litter in his fowl-house piling up under the dropping-boards and perches. This is due to the fact that the birds when scratching for their food in the litter always work with their heads towards the light. Thus as the litter is daily scratched back it necessarily follows that it soon becomes piled up at the back of the house. No doubt if light were provided by means of glass frames being placed low down in the back wall of the house the trouble would be minimized. It is questionable, however, whether the expense of doing this is warranted, as, after all, it is not a big job to frequently spread the litter with a fork, and from all standpoints will have a beneficial effect.

GREEN FEED.

I would again emphasize the importance of losing no time in making every possible provision for the growing of ample green material. No flock can possibly thrive without it, and this applies specially to growing chickens. An abundance of green feed not only greatly assists in keeping the birds in a healthy state, but in addition it reduces the grain account. It is common for both growing and adult stock to go off their grain ration when hot-weather conditions prevail, but rarely if ever will they refuse succulent green material. Where possible a variety of green feed should be provided, as birds of all ages are apt to tire of any one particular kind when it is fed in surfeit. For example, I have seen flocks of poultry absolutely refuse to eat silver-beet, as they had received nothing else as green feed for months previously. Finely chaffed succulent grass, lucerne, clover, and green oats are ideal green foods for poultry, while any of the brassicas (cabbage family), lettuce, or silver-beet will be much relished.

CULLING THE POOR LAYERS.

This is not the time of the year for culling poor layers; it should have been done in the autumn. It may be true of many flocks of hens that they have eaten much costly food of late, but produced few, if any, eggs. The natural laying season is now at hand, and it will be a very inferior bird that will not give a profit over its keep until just before the next moulting season commences. If eggs in good numbers are to be secured during the dear season, sufficient pullets must be reared each year to replace a good portion of the adult stock. Not only this, but they must be brought out at the right season of the year, which is between now and the end of September, or early in October at the latest.

REARING DAY-OLD CHICKS.

Many people who purchase day-old chicks and adopt the natural method of rearing them make the mistake of giving the hen charge of the young birds only a day or two after her broody period has commenced. This invariably means that the hen does not take kindly to them, and as a result the chicks get chilled. Another drawback is that the hen will probably resume laying in a short time, and cease to properly mother the chicks until they are able to look after themselves.

When a broody hen is being used for mothering artifically produced chicks it will be wise to allow her to sit on the nest for at least ten days

before giving her the care of the young birds. As a general rule, the longer the hen is allowed to remain broody—up till, say, three weeks—the better will she mother the incubator-hatched chicks. Where trouble is experienced in getting a hen to take charge of chicks not hatched by herself it is a good plan to take each chick and work it well between the hen's underfeathers. Especially is this the case with chicks hatched by another hen. The operation should be carried out when it is dark.

EMDEN GEESE.

A correspondent is desirous of securing some purebred Emden geese or eggs of this breed. I should be glad to have the name and address of any breeder who has either birds or eggs available for disposal.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

BREEDING.

Colonies in normal condition should now have a good quantity of sealed brood in the combs, and young bees emerging every day. The queens will be laying well, though not up to their full capacity; but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will soon be acting as field-bees, and the older autumn-bred ones will be dying off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention. It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for feeding the brood. All through the spring, when weather conditions are favourable, some nectar can be gathered, and often a good deal is stored, which helps to supplement the stores in the hive. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last several days the food-supply will diminish rapidly and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

HINTS TO BEGINNERS.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted; cracks and knot-holes may be of use for ventilation in the summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts; moreover, any holes besides the entrance offer an inducement for robbers to investigate, and necessitate the bees employing

extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood; but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feed only in the evening, inside the hives, and use a syrup in the proportion of two parts water to one part sugar; dissolve thoroughly, and feed as soon as it has cooled sufficiently to be harmless to the bees.

Provide permanent shelter; a live hedge is the best if kept trimmed to a height of 8 ft. or 10 ft.; failing this, some kind of breakwind is essential. The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent.

Open the hives only on warm, still days. Make necessary observations as quickly as possible, and take a note of them at once. The inside of the cover makes a good rough diary, and does not get lost or mislaid; mark the date of each examination. Endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen; she is easily distinguished by the length of her body and the comparative shortness of her wings. Try to make a rough estimate of the weight of each frame as you lift it, comparing it in your mind with that of an empty comb, thereby arriving at some idea of the quantity of stores in each hive. Do not try to run many hives until the rudiments of the business have been grasped, but be content with one or two strong colonies until the learner's stage has been passed.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

TOMATOES AND OTHER FRUITS.

Tomato-plants in the cool greenhouse will now be getting established. If the soil was well saturated before planting, further supplies of water should be given with caution at this season; anything like a moist atmosphere is to be avoided. Then, with a minimum temperature of 55° F. at night, and a little ventilation as soon as 65°-70° is reached during the day, the plants should make steady growth and fruitful flower-trusses. Close the houses early in the afternoon before the temperature declines. While the plants must not be grown soft, remember it is a sudden chill which causes the check that is so often manifested by blossoms falling without setting. Watch the plants closely until feeling sure they are established satisfactorily. A little fertilizer will push them if they are slow, or steady them if inclined to bolt—a tendency that is rather the more dangerous and common of the two.

Seeds for outside crops may be sown now. The common practice of making one sowing and holding the plants over for later planting is not good. The check given to the plants in that way is recovered, but not in a manner satisfactory to the commercial grower, who

requires good bottom bunches at an early date. Peppers and egg-plants may be included in this sowing; they require similar treatment. Very little extra heat will be required in the frames if the place is well sheltered. Have extra covers ready for a frosty night.

Consideration should be given to the area in which these plants are to crop. If the ground is under green cover-crop at the present time the growth should be ploughed in. If the plants are to follow winter broccoli or cauliflower the land should be cleaned up as soon as it is available, ploughed, and in most instances given a fair dressing of burnt lime. The preparation should also include a light stroke of the harrows or cultivator during bright, dry weather, and at short intervals, to destroy weeds.

Where passion-vines have to be planted they should be put out now, also any hardwood fruit-trees and bushes that may be decided on. This class includes one or two interesting novelties that are now available in small numbers and ready for trial. The Chinese gooseberry and the blueberry are both genuine novelties here, and popular useful fruits where they are grown. The former is a handsome deciduous climber that is doing well in alluvial soils. It is standing our frosts well. The fruit ripens in autumn, and may be kept for some time; it may be used for dessert or preserves. The stamens and fruit are borne on separate plants—the plant being dioecious. The blueberry is a very hardy plant which prefers drained acid soils. Some of the varieties introduced bear fruit of good size, and promise to do so abundantly

Fruiting brakes will now require careful consideration and inspection for any sign of disease. Bordeaux mixture and arsenate-of-lead sprays should be used freely where the health record has not been up to the mark. The lead is a check on grubs and eating-insects, such as those that attack the canes and buds of raspberries in the spring. The ingredients may be mixed into the one spray, and it is then a very excellent remedy.

TOBACCO-GROWING.

The new crop: Where the tobacco seed-beds are inclined to be wet they will require airing occasionally; although they must not be allowed to become dry, too much moisture is equally undesirable. Keep a sharp lookout for the attack of vermin, and deal with it promptly. A successful crop depends on, as much as anything, good early plants; these may now be produced by close attention to detail. Sow another seed-bed now; never mind if it is more than you require. There are many risks to encounter, and the safe way is to have plenty of plants, both early and later. Where the seeds come up thickly, thin them out to about 1 in. apart; crowded, they can never make good plants. Continue the preparation of the land where the crop is to be grown to maturity. If it is at all exposed to winds, plan to plant a shelter-crop at intervals so as to afford protection. The land should be ready for planting towards the end of October, when it should present a clean, firm, smooth, fine bed for the plants.

Home fermentation: Growers experimenting with tobacco, and who have a small quantity of last season's leaf which they wish to

ferment and prepare for smoking, may bulk it now. With a small quantity this is best done in a box of convenient size. When the leaves are in a pliable condition, remove the midrib and spread the leaves in the box with the tips towards the centre. Moisten each layer with a fine spray till it is carrying about 15 to 20 per cent. of moisture. When the box is full, place boards over the top and a moderate weight, so that they may compress the tobacco. Cover with a waterproof sheet, and keep the box in a temperature of about 70° F. Inspection should be made from time to time to ensure that the temperature of the leaf does not rise too quickly; 10 to 12 degrees per day is sufficient, and it should not much exceed 100° F. Should it do so, it will be advisable to break down the leaf, air it, and rebuild the bulk. After a few weeks the heat will subside and the tobacco be ready for use. It will, however, improve with age under proper storage up to about four or five years.

MARKET-GARDEN SUPPLIES.

The spring crops of cabbage, cauliflower, and lettuce will now be maturing for the harvest. Cabbages may sometimes be induced to produce a second crop by giving the roots a dressing of nitrate of soda and thinning the young sprouts.

Rhubarb and asparagus beds will also be presenting a profitable crop where they have been well fed and allowed to make strong autumn growth. The feeding of these strong-growing crops requires careful consideration. An application of nitrate of soda, 1 oz. to the square yard, on the asparagus-beds will be beneficial at the present time.

Every advantage should be taken of the occurrence of fine weather to thin and weed the growing crops. A small application of nitrates may be given to such as appear backward or slow in making satisfactory growth.

The preparation of the land for the main and half-hardy crops and seed-beds for autumn crops should now be in hand. Arrange that they follow crops of a totally different character, and so avoid disease and use the plant-foods in the soil with economy.

LAWNS AND SUNDRY PLANTING.

Mowers will require to be keen and well set to deal satisfactorily with the heavy work of the next two months. Every care given to these delicate machines will be well repaid by easier and better work. Lawns that have been well top-dressed with other fertilizers may now be given a dressing of sulphate of ammonia to encourage the growth of the finer grasses.

The planting season for hard-wooded plants closes with the month of September, and the sooner such work is completed the better. The chief danger of late planting is the possibility of a dry spell delaying the establishment of the plants before the warm weather arrives.

—W. C. Hyde, Horticulturist, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SELECTION OF RAM FOR BREEDING.

A. MORTENSEN, Ngatamiro :—

I would be obliged if you could give me a few hints about how to pick a good Romney ram for wool, shape, and quality.

The Live-stock Division :—

This subject was dealt with in an article entitled "The Ram and his Characteristics," published in the *Journal* for October, 1922, a copy of which has been sent to you. A few further hints may be added. In all the hornless breeds of sheep the space between the ears should be as level as possible. Moreover, a good width here means a good width between the eyes, and this is a very desirable characteristic. The ears should be fairly well set up and not lopping down. The pure-wool fibres in a fleece are of a soft silvery appearance, and are elastic throughout. This is the wool required by manufacturers. The hairy-wool fibres, on the other hand, are a white colour and non-elastic. One must look for these fibres mostly in the britch, and by selective breeding avoid them as far as it is possible to do so. When doubtful which ram to finally select out of any submitted for examination, other points being equal, take the one with the broadest pad in the top jaw and with the almost square-shaped hoof.

GROWING OF ARTICHOKES.

J. R. SMART, Tikorangi :—

Kindly give me instructions how to plant artichokes and to cultivate same. Also, is there a spray for the blight that attacks them ?

The Fields Division :—

Artichokes are grown much on the same lines as potatoes. Planting may be done in your district any time after 1st September. Plant in drills 3 ft. apart, and set the tubers 2 ft. apart in the rows. From 5 cwt. to 7 cwt. of seed per acre is required. If the seed is small, plant whole, but if big, break into sets. In buying seed, arrange to have it dug just before required. There are two varieties grown in Taranaki, the pink and the white. The latter is rather the heavier cropper, but is more liable to attacks of blight. Care should be taken to get seed free from blight. Spraying or dipping affected seed or crops does not appear to be very effective (see article, "Fungus Disease attacking Artichokes," in the *Journal* for June last). A suitable manure for artichokes is 3 parts super, 1 part bone or Nauru phosphate, and 1 part 30-per-cent. potash —4 cwt. to 6 cwt. per acre ; or a proprietary mangold or potato manure may be used.

PASPALUM FOR SWAMP LAND AND COASTAL FLATS.

"KAI KAI," Marton :—

Can you tell me if it is safe to sow paspalum on rich swamp land ? I am afraid of it becoming a nuisance, like giant fescue, on this class of country. I would like also to know whether in your opinion paspalum is suitable for light sandy soil and the small poor flats that are to be found near the coast between sandhills in this district.

The Fields Division :—

If the swamp land is not likely to be drained and broken up for a considerable period it is quite safe and good practice to sow it in paspalum. This grass will not become a nuisance like giant fescue, as stock are very fond of it, and do well on it. In our opinion paspalum is the best grass available to sow on the light flats you mention. If it is used for this type of land from ½ lb. to 1 lb. of subterranean clover should be sown with it, as the two grow well in association. Examples of paspalum on the type of flats you mention are to be seen on portions of the Hellier Estate, below Bull's.

CHAFF FOR PIG-FEEDING.

"PIGGIE," Te Kopuru :—

Kindly advise if it would be injurious to feed pigs on chaff with an addition of meal. I notice young pigs relish chaff, and as I have a considerable amount on hand it might be better to give it to the pigs than dispose of it by sale. The pigs are on top-dressed pasture, supplemented with meal and turnips.

The Live-stock Division :—

Chaff is not a suitable food for pigs, and it is doubtful whether the animals are really fond of it. No doubt they are trying to pick out the oats from among the chaff, and in doing so are compelled to eat a certain amount of the latter, which is hard to digest and of little feeding-value for pigs. If you have no other means of feeding your chaff it had better be sold, when the value received could be spent on pig-meals, which would show a better return.

SMOKING OF HAMS AND BACON.

F. ROCKELL, Kaikohe :—

As we intend to smoke our bacon this year I would be glad of your advice on the subject. Could the smoking be done in an ordinary farm-shed ? To what temperature is it advisable to let the smoke-house come ? Does it matter what fuel is used ? How long should the bacon stay in the smoke-house ?

The Live-stock Division :—

Any tight house with ventilation in the top can be used to smoke meat in. First of all, however, the sides and hams to be smoked should be well washed and hung up outside to dry. As regards temperature in the smoke-house, it is not usual on a farm to pay any attention to this. If the house has a ventilator at the top, and the fire is not allowed to burst into flame, but only smoulders, the temperature will not go up too high. Resinous-pine woods should be avoided, as they give a bad flavour. Straw, sawdust, and dry leaves are commonly used, but probably the best is rimu sawdust spread over logs and shavings. The period for the bacon to remain in the smoke-house may extend from forty-eight hours to two weeks if desired.

TEMPORARY PASTURE AND SMOTHERING OF COUCH.

A. L. ROSS, Matiere :—

I am ploughing a 7-acre paddock which was in rape, with the intention of sowing Western Wolths rye-grass and cow-grass for a hay crop. The paddock is fairly couchy, and I would like advice on the most suitable mixture for hay to last about two years, and that would also help to smother the couch-grass.

The Fields Division :—

The paddock should be sown in the spring with a smothering-crop of oats or Black Skinless barley. This could be fed off during late summer, and a temporary pasture mixture of 25 lb. Western Wolths rye-grass and 6 lb. cow-grass per acre sown in the autumn. As an alternative to this you could sow the grass with the oats in spring, and thereby save a further ploughing ; but, since the function of the cereal crop is to smother the couch during its most vigorous growing period, this method would not always be satisfactory to the early development of the temporary pasture.

RYE-CORN FOR POULTRY.

B. C., Middlemarch :—

Please tell me if rye-corn has any value as poultry-food.

The Live-stock Division :—

Rye-corn is not a popular grain for poultry-feeding. Fowls do not like it, and will seldom eat it if other food is available.

NOTE.—C. McGregor, "Central Otago" (inquiry regarding shelter-belt), should forward his postal address.

WEATHER RECORDS: JULY, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE total precipitation of the month was above normal over the North Island, with the exception of small areas about Cook Strait and at Kawhia and Gisborne. In the South Island there were considerable local variations in the amounts measured, but Nelson and Marlborough had an excess, and also isolated places on the east coast and in western Otago. Westland, North Canterbury, and most parts of Otago recorded less than the mean. In some districts, notably in the Bay of Plenty and Hawke's Bay, the excess was considerable.

There were three outstanding storms during the month, which may be briefly described as follows: A cyclone from the north-westward was centred over the Auckland Peninsula on the 1st, and passed off East Cape on the night of the 2nd. On these two days some phenomenal rainfalls occurred in the Gisborne and Hawke's Bay districts, resulting in serious floods in the low-lying country. Between the 9th and 14th an intense and extensive westerly low-pressure area dominated, with strong northerly winds changing to southerlies about the 13th. Much rain fell during this period, and on the 13th there were heavy snowfalls on the high country in the South Island, also in the central portion of the North Island. Waiouru recorded a fall of 17 in., and at Taumarunui it was regarded as the heaviest fall since 1918. From the 25th to the close of the month a wide and extensive cyclonic disturbance operated between New Zealand and Australia, and conditions were again extremely unsettled, with strong north-east to south-east winds. Although precipitation came mostly in the form of drizzle, some heavy rains were occasionally experienced, particularly in the northern and east coast districts on the 25th and 26th.

In many parts of the North Island the continuous rain accounted for serious floods and landslips, which interfered with railway and other traffic.

Fair weather ruled between the 3rd and 8th, and other shorter fair periods were experienced, but usually the duration of sunshine was below the average. Temperatures, however, were about normal, and above the mean of the preceding month. Generally there was a good growth in vegetation for the time of year.

RAINFALL FOR JULY, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	11·01	21	2·72	5·96
Russell	8·24	15	2·16	4·94
Whangarei	9·73	21	2·19	7·53
Auckland	8·47	29	2·88	4·98
Hamilton	6·85	24	1·40	5·02
Kawhia	6·41	26	1·07	6·86
New Plymouth	7·48	25	1·33	6·28
Riversdale, Inglewood ..	9·97	25	1·58	9·93
Eltham	7·53	27	0·87	5·55
Whangamomona	8·24	20	1·33	7·68
Tairua	1·44	20	2·53	5·15
Tauranga	11·10	23	2·58	4·86
Maraehako Station, Opotiki ..	10·20	17	2·04	4·09
Gisborne	4·98	10	2·23	5·14
Taupo	4·89	9	1·67	4·21
Napier	5·14	15	2·13	3·90
Maraekakaho Station, Hastings ..	8·00	16	3·02	3·05
Taihape	3·19	18	0·79	3·15
Masterton	4·67	21	0·86	4·31
Patea	4·30	17	0·93	4·10
Wanganui	1·45	5	0·93	3·52
Foxton	2·34	13	0·80	3·09
Wellington	3·46	20	0·50	5·55

RAINFALL FOR JULY, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	6·20	20	1·34	6·99
Greymouth	7·36	16	1·40	7·84
Hokitika	8·54	17	2·45	9·08
Ross	6·63	13	1·84	9·94
Arthur's Pass	10·88	13	4·03	11·55
Okuru, Westland	..	..	..	12·03
Collingwood	16·75	17	3·32	9·65
Nelson	6·39	12	1·90	3·49
Spring Creek, Blenheim ..	3·92	10	0·83	3·40
Tophouse	5·10	11	1·25	4·79
Hanmer Springs	4·20	14	1·46	4·65
Highfield, Waiau	3·24	13	1·90	3·44
Gore Bay	3·60	17	1·11	2·84
Christchurch	2·46	15	0·78	2·76
Timaru	2·72	11	0·68	1·93
Lambrook Station, Fairlie ..	2·14	8	0·74	2·61
Benmore Station, Clearburn ..	1·84	12	0·54	1·74
Oamaru	3·99	11	0·91	1·74
Queenstown	2·41	8	0·50	2·04
Clyde	0·76	5	0·47	0·94
Dunedin	7·51	15	2·57	3·01
Wendon	1·36	9	0·30	1·98
Gore	1·75	17	0·45	1·96
Invercargill	2·86	21	0·50	3·28
Puysegur Point	9·44	15	1·02	6·18

GRADINGS OF BUTTER AND CHEESE, SEASON 1926–27.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelvemonth ended 31st July, 1927, were as follows:—

Butter: Salted, 69,433 tons; unsalted, 2,262 tons: total, 71,695 tons—an increase of 14·6 per cent. compared with the figures for the preceding twelvemonth.

Cheese: White, 50,427 tons; coloured, 25,885 tons: total, 76,312 tons—an increase of 2·9 per cent.

In terms of butterfat, the 1926–27 amounts for butter and cheese combined represent a net increase of 10·47 per cent. compared with those for the preceding year, and an increase of 4·77 per cent. over those for 1924–25, hitherto the peak production year. A new high-level record has thus been established.

Grading-weights of Lambs.—"The suggestion was made some time ago," states the annual report of the Meat Board, "for an alteration in the grading-weights of lambs, by extending the range of weights so as to allow heavier lambs to be included. The Board does not consider that alterations along these lines would be in the interest of our trade, for they would be against the requirements of the Home trade, and it is essential, if we are to hold our own with the keen competition of other countries, that we give consideration to and comply with the requirements of our customers."

DAIRY FACTORIES IN NEW ZEALAND, 1927.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1927, and the numbers of milk or cream suppliers to the factories :—

District.	Number of Factories.				Forwarded for Export, 1926–27.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	65	36	6	107	43,081	11,612	17,100	1,327
Taranaki ..	24	74	35	133	7,901	33,039	3,271	3,466
Wellington ..	19	49	10	78	7,002	11,277	4,958	1,627
Hawke's Bay ..	14	15	3	32	2,364	3,004	3,594	519
Nelson	6	5	2	13	1,045	438	1,075	455
Marlborough ..	3	1	4	8	699	669	750	185
Westland ..	9	..	1	10	371	..	639	30
Canterbury ..	9	12	5	26	2,138	1,966	4,425	2,296
Otago and Southland	13	77	2	92	2,250	13,360	6,660	2,730
Totals ..	162	269	68	499	66,851	75,365	42,472	12,635

Whey butter was manufactured as a side-line at eighty-one of the above cheese-factories in 1926–27, the total quantity forwarded for export being 1,036 tons. This is not included in the total amount of 66,851 tons of butter given in the table, which refers to creamery butter only.

In the 1926–27 period there were also operating in the Dominion six milk-powder factories (three whole-milk and three skim-milk plants), four casein-factories, one condensed-milk factory, and one sugar-of-milk factory.

VARIETIES OF APPLES AND PEARS EXPORTED, SEASON 1927.

THE following particulars of the varieties of apples and pears exported from New Zealand in the past season have been compiled by the Horticulture Division from export certificates. The figures for apples represent 1-bushel cases, and those for pears crates consisting of three trays, each tray containing from 10 lb. to 12 lb. of fruit.

Apples.—Sturmer, 157,358; Jonathan, 118,556; Delicious, 91,063; Dunn's, 28,368; Cox's Orange, 24,347; Dougherty, 18,961; Statesman, 16,519; London Pippin, 9,082; Cleopatra, 7,626; Worcester Pearmain, 5,979; Lord Wolseley, 4,616; Premier, 3,607; Rome Beauty, 5,815; Rokewood, 2,608; Newtown Pippin, 2,510; Scarlet Nonpareil, 2,539; Tasma, 2,410; King David, 2,171; Ballarat Seedling, 2,076; Stayman Winesap, 2,109; Alfriston, 1,909; Adams Pearmain, 1,566; Pioneer, 1,317; Gravenstein, 1,244; Spitzenberg, 1,164; Stark, 789; Granny Smith, 718; Willie Sharp, 511; Brownlee's Russet, 507; Hoover, 430; Ribston Pippin, 410; Washington, 445; Salome, 379; McIntosh Red, 397; Shorland Queen, 377; Simmonds Winter, 311; Yates, 202; Boston Russet, 164; Baumann's Reinette, 150; Blenheim Orange, 100; Edward Lippiatt, 100; Rona, 97; Parlin's Beauty, 95; Golden Pippin, 84; Frimley Beauty, 64; Shepherd's Perfection, 54; Cambridge Pippin, 50; Celo, 37; McMahon's White, 25; Senator, 10. Total number of cases, 522,146.

Pears.—P. Barry, 6,835; Winter Nelis, 4,368; Winter Cole, 4,063; Keiffer, 1,676; Vicar of Winkfield, 1,444; Josephine de Malines, 1,230; Beurré Clairgeau, 861; Packham's Triumph, 432; Beurré Bosc, 313; Elizabeth Cole, 273; Beurré Diel, 160; Doyenne du Comice, 128; Beurré d'Amanli, 90; Conference, 67; Glou Morceau, 60; Beurré d'Anjou, 28; Le Conte, 25; l'Inconnue, 19. Total number of crates, 22,072.

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BRAXY-LIKE DISEASE OF SHEEP IN HAWKE'S BAY.

ITS ASSOCIATION WITH LIVER-FLUKE.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

FOR many years farmers in a portion of Hawke's Bay Province have been losing sheep from a trouble resembling braxy, yet differing in many respects from that well-known disease. So serious were losses on certain farms that active investigation by the Department of Agriculture became a necessity. Farmers in the district in question could readily understand losses from such causes as liver-fluke, but at certain times of the year the braxy-like disease was taking toll daily of the best-conditioned animals in the flock, and death came so suddenly that a sheep might be found lying where the observer had walked scarcely half an hour previously, when all appeared to be in normal health. Usually, however, deaths occurred on the night camping-grounds, and it was common to find perhaps half a dozen sheep lying on their sides—apparently asleep—in those places. On cold, frosty mornings such carcases would be in a fairly well preserved condition in spite of the amount of wool covering them, while rigor mortis had frequently not set in.

In earlier years, when large stations were usual, the condition described was apparently unknown, but at that time the liver-fluke took its toll, and a number of owners drained their land for the purpose of destroying the parasite. In later years, when large properties were cut up into 1,500- to 2,000-acre blocks, more sheep were run on the land, and it was then that the disease in question made its appearance.

The disease was called "braxy-like" on account of the sudden death of the animal, the typical smell, and the skin-discoloration. It did not resemble braxy in that sheep of any age might be affected, and no stomach or intestinal lesions could be found as in true braxy. It is of interest to note here that true braxy, caused by a bacillus named *Vibrion septique*, is unknown in New Zealand. Also, deaths from true braxy occur only in frosty weather, while in the trouble now under notice weather conditions do not control the course of the disease to the same extent.

On farms where one comes across the mortality the country is usually hilly but ridable on horseback, lying fairly near the sea-coast, well watered, and holding many small swamps, a feature which old settlers view with satisfaction, as such places ensure green feed in dry weather. The soil makes a very tenacious form of swamp when it is washed into the creek-bottoms during heavy storms, and the great number of springs to be seen on the hillsides, each with its little bog, makes drainage a really difficult problem. Because of these swamps and the presence in them of the intermediate host snail, together with the warm climate, liver-fluke is prevalent in this area, but, curiously enough, stomach-worms in the hoggets are not of very great account. The water of the district is alkaline in reaction (pH 7·2), and many outcrops of limestone are seen on the ridges. Feed grows most of the year, and when rain is sufficient the sheep need only go to the creeks for water. A proportion of sheep, however, always appear to prefer the rank feed of the swamps. Another fact which strikes the observer is that on nearly every farm many bones are found lying about. This is accounted for by deaths caused chiefly by drought, but also by fluke and the braxy-like disease. Shepherds have taken the wool off the carcase and left the latter to rot, with the inevitable result that the soil is dangerously fouled, especially in and about watercourses or swamps. The wonder is that there is not a greater mortality from the numerous gas gangrene organisms which must be present. On most properties in the district this treatment of carcases has gone on for some forty or fifty years. Common-sense warns one to bury or thoroughly burn. In the South Island at one time there were many outbreaks of a somewhat similar disease where hoggets on turnips died suddenly. This was overcome mainly by correct disposal of carcases.

As weather conditions are one of the factors in the normal mortality of sheep of the district some attention should be paid to this phase. In 1924 a very heavy flood washed out all the watercourses and freed the many gullies of their swamps. The following season fluke is said to have been less harmful, owing to the fewer snails. The summers of 1925 and 1926 were very dry, particularly that of 1925, when a real drought was experienced. Deaths from all causes were very heavy in that year; but there was very much less water about the country in the winter of 1926, so that there appeared to be a lessened fluke infestation in the summer and autumn of 1926 *27*. The warm weather, however, appeared to commence exceptionally early after the winter of 1926, and the larval fluke made its way through the snail host at a very much earlier period than usual. In fact, flukes were passing into the sheep last New Year. Quite a decided wave of the braxy-like disease appeared at this time, and was prevalent more or less for a couple of months, when it quietened down, to reappear about the beginning of May. The usual months to expect to find sheep dying suddenly are from May to August, but much depends on the weather. If many frosts occur the disease may end earlier, or if sheep are able to stay out on the hills feeding, instead of having to seek the damp bottoms during the summer, then mortality from all causes is light.

POST-MORTEM EXAMINATION.

The most active work of the investigation commenced last year, when a stay was made on several farms with the object of getting

material for laboratory examination and experimentation. Many sheep were examined after death for some lesion which might give a clue to the cause of death, and the conditions described below were always encountered in every carcase, whether ram, ewe, wether, or hogget. Age had no influence on the course of the disease.

Sheep were lying either naturally or on their sides, with rarely any sign of a struggle ; pupils dilated ; wool easily plucked. If an hour or two dead, the skin was very dark, due to congested blood-capillaries. There was a definite smell, not of a putrefactive nature, but unpleasant, said to be somewhat like that of braxy. On opening the carcase the thorax showed the lungs usually normal, but occasionally œdematous at the apex. Often a straw-coloured or slightly blood-stained fluid was present in the chest-cavity, while the pericardial sac surrounding the heart was tensely distended with straw-coloured fluid. The heart itself showed small petechial areas mainly over the auricles, and the endocardium showed a marked staining, a condition often seen in toxæmias. In the abdominal cavity congestion of capillaries of the omentum was noticeable. Sometimes a fair quantity, up to a cupful, of straw-coloured or slightly blood-tinged fluid was to be seen, but usually in recently dead sheep only a tablespoonful or so of such fluid could be found, though the peritoneal lining appeared damper than in health. Thorough examination of the gastro-intestinal tract showed absolutely no trace of braxy lesions, but there were some patchy flushings of the stomach mucous membrane and some inflammation of the duodenum about the entrance from the stomach, particularly in every case at the flexure of the duodenum beneath the liver in the vicinity of the entrance of the bile-duct from the liver. The large intestine was often inflamed and catarrhal, but this appeared to be more seasonal than pathogenic. There was some congestion of the kidneys, but a pulpy condition as seen in toxæmias, considered to be due to protein in breakdown products of food (for example, in pulpy kidney of lambs), was not observed. The spleen and other organs were normal, except the liver.

The liver appeared to be the chief seat of change. The district, it must be remembered, is a fluke-infested one, and adult flukes were frequently met with in the bile-ducts of the liver ; but in all livers one impressive fact was the presence of young flukes which had just entered the capsule and had not reached the small bile-duct. Some flukes were actually seen penetrating the capsule of the liver, the size of such specimens being about $\frac{1}{8}$ in. In the 1927 investigational work often only one young fluke was found in the whole liver, while in 1926 sometimes dozens could be counted. Young flukes burrow here and there in the liver substance, seeking a bile-duct in which to mature, and during their burrowing cause a very great damage to liver-tissue. These burrows are filled with blood-corpuscles, both white and red, and are in reality areas of acute inflammation under normal conditions, owing to the body's physical objection to the entry of a foreign material into its substance. Besides the young flukes, in 100 per cent. of authentic cases there was to be found in the liver a small necrotic area or grey-white patch, commonly the size of a threepenny-piece, and surrounded by an intensely hyperæmic area of liver for possibly 2 in. (Fig. 2). Such necrotic areas followed one of the fluke-burrows. It was not necessarily always on the surface of the liver

that the necrosis could be seen, but in some cases, by careful observation, congested areas could be found on the surface, with a central necrotic area deep in the liver-substance. Young flukes were several times observed dead in such areas.

In contradistinction to the foregoing cases, in both seasons several sheep were seen to die having as chief lesions an acute congestion of the central veins of the lobules of the liver, but they showed no area of necrosis, although young flukes were present. In such cases, too, death was not so sudden, but might be a question of many hours, the sheep comatose, often with its head pushed into a fence or other object which it had come against in its semi-conscious and blind wanderings. In one such case there was a great deal of cirrhosis of the liver due to fluke invasion some time previously, while in another the sheep had been drenched with carbon tetrachloride, the liver being fatty and to some extent cirrhotic.

MICROSCOPICAL EXAMINATION.

The findings of a microscopical examination of fluids and tissues depended largely on the time which had elapsed after death. Sheep recently dead did not show organisms in the peritoneal fluid nor in the substance of the liver, except in the necrotic area. The muscular and peritoneal coat of the intestines taken from over the flexure near the liver in the few cases examined showed a large bacillus, but these organisms may have got there after death. Pericardial fluid and blood were both sterile. Where an organism was definitely present was in the central necrotic area of the liver, and here in every case a large bacillus was found, occasionally showing spores, a fact which suggested that it was not an accidental organism introduced after death. Those lesions in the heart-walls showed a congestion of blood-spaces beneath the endocardium, in some cases so large as to be hæmorrhages. The intestinal and stomach walls showed no abnormalities which could be associated with the disease, except a congestion of the capillaries in parts of the mucous membrane. Organisms could be seen in some cases entering via the peritoneum, but in no case was one fortunate enough to observe the path of entrance of young fluke with the possible path of invasion of the organism causative of death.

Sections of the necrotic areas of the liver under the microscope were exceptionally instructive, and could be described as a battle on an intense scale between the enterprising invading enemy—the bacillus, which used a particularly deadly toxin to do its work, causing the coagulative necrosis of the liver-tissue and the blood forces of the body. The congested area contained armies of blood-corpuscles massed ready, the white corpuscles to phagocyte or produce antitoxin against the bacillus, and the red to carry oxygen to the part for the use of the body-tissues. Felted masses of the invading bacilli could always be seen under the microscope against a thick wall of leucocytes (white corpuscles). Behind the massed bacilli were odd single members throughout the necrotic area. In some cases the burrowing fluke had been overtaken, and had been poisoned and treated in the same way as the liver-tissue itself. Sporulating forms of the bacillus were noticed in several cases, leaving no doubt that the organism had been in position for at least eight hours, while the sheep had possibly been dead less than one hour.

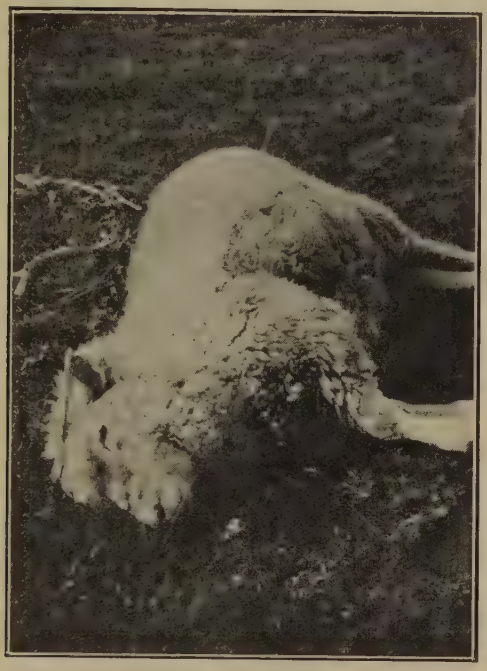

FIG. 1.—SHEEP DEAD FROM BRAXY-LIKE DISEASE.

This animal was found lying with head downhill, as though it had stumbled and died without struggling.

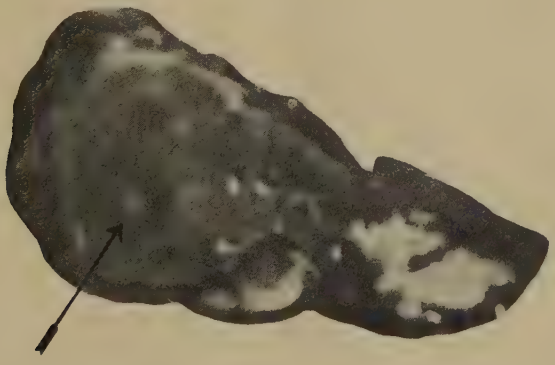

FIG. 2.—SHEEP'S LIVER EXAMINED IN FIELD.

Showing a darkened congested area with central necrotic spot (indicated by arrow). The distended gall-bladder may be seen at bottom of liver.

FIELD-LABORATORY WORK.

Culture material was utilized in 1926, but, unfortunately, no results of any significance were obtained. This year, however, a small field laboratory, with incubator, guinea-pigs, and a microscope, was taken to one of the farms, and preparations made for an intensive investigation, it being decided that no opportunity for securing good specimens should be lost. In May fortune attended the venture, and an organism was isolated from a sheep's liver, both by inoculation of a guinea-pig and by growing the material anærobically in broth with a portion of the liver added. A flocculent growth of a large bacillus growing singly or in large chains, and in size about 1 by 8 micromillimetres, with ends slightly rounded, gram-positive, and strictly anærobic, resulted in the tube. It was found to grow well in a medium made of cooked minced liver, either sealed or unsealed, also in liver-broth if a small portion of meat was added. Growth occurred in cooked-meat media made of bullock's heart, but not so much on the surface as in the bulk of the medium, where it formed large oval almost terminal or eccentric spores. Other media were of little use; milk showed no growth after ten days, while no growth could be obtained in visible colonies on anærobic surface media in glucose or lactose agar. In solid media, however, it seemed that if thin slices of the surface were taken and stained, colonies of some hundred or so organisms could be seen, the colonies being very feathery. No colonies which could be definitely identified as the original organism could be obtained in shake glucose or lactose agar, while no growth at all occurred in gelatine. Therefore, as a routine, cooked-liver medium was used. The drawback was the very acid reaction produced in the medium after a few hours' incubation, this tending to kill out the organism altogether after a period of two months (so it was subsequently found), the more so as spores were not readily formed in such medium. No blackening of media occurred, the organism being purely a sugar-user.

Guinea-pig subcutaneous inoculation has given typical lesions in every case. With 0·2 c.c. of culture, or with a small portion of liver from the sheep, the guinea-pig dies within twenty-four hours. Within six hours the leg is swollen, and shortly afterwards the animal is moribund. Peritoneal inoculation, on the other hand, has not caused death so readily, and in some cases the experimental animal has shown no ill results. In carrying out experimental work at Wallaceville with the isolated organism it was found that inoculation of sheep with a small amount of culture into the liver directly caused death of the animal in twenty-three hours, with all lesions typically presented as though the sheep had died on a farm in the affected locality.

Post-mortem examination of guinea-pigs inoculated in the thigh shows an intense gelatinous œdema of the subcutaneous tissue, extending as far as the anterior of the chest in many cases. There is practically no gas-formation, except occasionally a few bubbles in the subcutaneous tissue on the posterior end of the abdomen. The muscles of the leg are pale, with small hæmorrhages throughout. Organisms are seen in the muscular tissue, often only few in number. None, however, is found in the œdematous fluid or on the surface of the liver. The condition is distinct from *Vibrion septique* or *Bacillus Chauvoei*

(blackleg) infection, and could belong only to one anærobe described in gas gangrene, but rarely described as being a pathogen in domestic animals, and that one is *Bacillus oedematiens*. The work on the farm gave little room for doubt that *B. oedematiens* was the causative organism leading to death of the sheep. It produces a very powerful toxin which itself kills guinea-pigs when given subcutaneously in small doses, the œdematous swelling resulting as when the bacillus is present. Gilruth's work carried out in 1902–3 on the braxy-like disease of hoggets on turnips also gave an organism which killed guinea-pigs, with the lesions exactly similar to the Hawke's Bay disease, so that probably the same organism caused deaths in the South Island. This form of mortality, however, is very much less frequent than formerly, owing, as has been already mentioned, to the proper disposal of carcases.

RELATED WORK IN OTHER COUNTRIES.

The description of the braxy-like disease as found in New Zealand tallies very well with the disease described by Dr. Dodd in New South Wales as "black" disease. He also found fluke present, and though he could not implicate it to the same extent as has been possible in New Zealand he believed fluke to be the primary contributing agent in the New South Wales disease. Gaiger in England and Miss H. H. Heller in the United States both considered that Dodd's black disease was caused by *Vibrion septique* and was thus a form of braxy. Both these workers based their opinion on post-mortem description alone, and not on observation of the actual organisms isolated. In April of this year Turner, working in Professor Weinberg's laboratory at the Pasteur Institute, Paris, published the result of work done in that celebrated institution on Dodd's black-disease organism. The published conclusions of these workers, which at time of writing have just come to hand, are that the causative organism is undoubtedly a strain of *B. oedematiens*. At the present moment a culture of *B. oedematiens* has been received from England for comparative tests at Wallaceville.

TENTATIVE CONCLUSIONS.

Two facts have presented themselves in this investigation: (1) The sheep are becoming infested with young flukes at the time of death; (2) necrotic areas in the liver are caused by a very toxic organism—*B. oedematiens*—and this organism is found in liver-tissue broken down by young flukes. Considerable thought has been given to the association of these two facts by both field and laboratory workers. In the field it has been noted (and several authentic cases could, if necessity arose, be given) that the disease under investigation, which could very well be named "liver necrosis of sheep," occurred very shortly after the known introduction of the liver-fluke on to the farms. One farmer, who has given great help in the present investigation, introduced fluke in locally bought sheep seven years ago, and has had deaths occurring on his farm for about six years.

Work done in connection with the life-history of the liver-fluke in Hawke's Bay is described in a separate article,* but it is easily seen by those conversant with fluke infestation of sheep that the two

* See page 175 of this issue.

conditions—fluke infestation and the mortality from this braxy-like disease—occur at the same season of the year, usually autumn and early winter. Deaths from fluke alone occur later in the spring and summer.

Until further research work has been carried out on the lines of experimental infestation of sheep with young fluke, and the simultaneous introduction of cultures of the *B. oedematiens* organism with feed, in order to ascertain whether the combination will produce a mortality, and until it has been possible to find a case unassociated with liver-fluke, it may be reasonably deduced that the liver-fluke is the introductory factor, and that *B. oedematiens* only follows in on the path of the parasite to the very favourable position in the liver where it produces toxins which kill the sheep suddenly. From the fact that the blood-stream remains sterile with regard to this bacillus it can be assumed that the infection is not blood-borne and therefore must enter through the intestinal wall. Feeding experiments with cultures of the bacillus were quite without effect. With the seasonal coincidence of fluke infestation and mortality of sheep one can then assume that the path of infection is through an injured surface of the gastro-intestinal tract. The actual path by which the fluke gains the peritoneal surface has not yet been noted, but from inflammatory areas observed it seems to be through the first part of the intestine principally.

Preventive Measures for Farmers.

The foregoing deduction being accepted as correct, the farmer must take steps to wipe out fluke in order to overcome this dangerous braxy-like mortality. Much has been written on this question, and departmental officers in Hawke's Bay are advising on the latest scientific lines as to the best methods. They are as follows :—

(1) Drainage of Swamps.

Swamps should be drained, not omitting any laterals. A good example of this latter point can be given. A sheep-farmer who has gone into the question whole-heartedly and intelligently drained his farm well, and where drainage was impossible used copper sulphate with deadly effect on the water snail. He did not, however, trouble about a few small patches on one of his creeks where a little watercress grew. During the past season a fairly heavy mortality occurred in this one paddock only, and on investigating the matter he found that areas which he thought were of little account were swarming with the water snail (*Potamopyrgus antipodum* var. *Zelandeae*), the intermediate host of the fluke. With these small areas under control he now looks confidently ahead to next season, when he expects to have only a very small loss, if any. Even this year it has been noticed on farms where drainage has been carried out thoroughly since 1926 that the losses are decreasing ; but until the drains have been kept going for at least two seasons, and remaining swamps constantly top-dressed with copper sulphate to wholly eradicate the water snail, one cannot be definitely certain of the result. Two seasons are mentioned because it does not seem possible, with every known method employed, to get rid of the fluke entirely in one season.

(2) Dressing with Copper Sulphate.

Copper-sulphate dressing is very valuable on areas which it is impossible to drain, such as hill-country swamps in positions from which there is no fall. Broadcasting, at the rate of 28 lb. of the powdered chemical to the acre, is the best method, but spraying of a 1-per-cent. solution might do equally well. The best time for carrying out this method is still a question, but to the writer summer-time appears best, when the snails are on the surface and are producing young, rather than to treat the more resistant eggs. Then, too, the swamps are more circumscribed in summer, and can be more easily walked over. Leaving dressing till too late in the autumn means the sheep becoming infested with adult fluke before the snails are killed. A time might therefore be chosen when the hill feed is still green, but when the winter and spring water has disappeared.

(3) Treatment of Sheep to eradicate the Adult Fluke.

As the adult flukes pass eggs from the liver to the surface of the ground, and so to the watercress, it is advisable to get rid of these adults. The most reliable method is by using a drug which will be excreted by the liver. Two are available—extract of male-fern root and carbon tetrachloride. The latter is the more easily used and is very much cheaper. Two methods may be employed to dose the sheep: (1) By means of the drug in 1 c.c. doses shaken up in a mineral oil as a vehicle, or (2) by means of capsules. These latter are cheap, easily given to sheep in a race by dropping into the back of the mouth, and, as far as known, are harmless, and particularly effective in killing adult flukes with one dose. They are now becoming extensively used in Hawke's Bay. Young flukes which have not gained entrance to the bile-ducts are, however, not killed by this means, so that the period for using the capsules must be well chosen, and will to some extent depend upon the season. The best time theoretically would be well on in winter—say, July. The farmer, however, could dose the sheep when he gets the lambs in for marking (carbon tetrachloride having no effect on lambs), and he could dose once previously at crutching-time, the two doses costing about 2d. per head. Apart from exceptional cases, it is not advisable to dose in the summer or autumn, when the sheep are being infested, but rather to wait till the flukes have become adult.

The three foregoing methods should be used together on the farm to get rid of fluke, but where the mortality also exists it is most essential that the greatest care be exercised in the disposal of carcases. They must be buried deeply or burned, and must not be left to rot on the ground, more especially in watercourses. Although *B. oedematiens* is found only in the liver at time of death, a few hours later it progresses all through the body of the sheep, and therefore passes into the ground in countless numbers to form a centre of danger to the flock in general.

The writer would like to record his thanks to those sheepowners who so kindly gave him information and laboratory-room on their farms. Assistance such as theirs is invaluable, and without it the present investigation would have fallen through. Acknowledgment is

also due to my colleague in all the field-work connected with this sheep mortality, Mr. E. E. Elphick, M.R.C.V.S., Departmental Veterinarian at Hastings. Mr. Elphick's article on "Liver-fluke in Sheep and its Control," published in the *Journal* for October, 1926, may also be referred to by farmers for practical information and advice.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR YEARS 1926 AND 1927.

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I.—MILLING-QUALITIES.

THIS year fifty-three samples of wheat have been experimentally milled by the Chemistry Section. Twenty-nine of these were grown in the 1927 harvest, and twenty-four in the 1926 harvest. Twenty-six samples were grown at Ashburton Experimental Farm, fifteen at Lincoln Agricultural College, and twelve at Horrelville and Methven—all in Canterbury. The average yield of flour was very satisfactory, that for the 1927 harvest being slightly higher than for 1926. In general the samples from both harvests were excellent in appearance, well filled, of good uniformity, and free from weathering. No wheats were more difficult to mill than the average, while several were easier. These are indicated in the accompanying tables.

1926 Harvest Wheats (Table 1).

Queen Fair (W 160) was the best flour-yielding wheat tested from the 1926 harvest, giving 77·4 per cent. flour. If one refers to the *Journal* for June, 1924, p. 403, it will be found that Queen Fair was also the best of the miscellaneous wheats tested in that year (76·8 per cent. flour). This year (1926) the variety (X 365) gave 76·6 per cent. This series of figures for three consecutive years (76·8, 77·4, and 76·6 per cent.) is interesting and significant. This wheat, together with Yeoman (W 156), gave excellent yields of flour. The good yields which Yeoman is now producing should be carefully noted, as this wheat may possibly also possess excellent strengths under New Zealand conditions.

Solid-straw Tuscan, White-straw Tuscan, Dreadnought, Jumbuck, College Hunter's, Goldberry, Red Marvel, College Velvet, Velvet Ngapara, and Yandilla King, all grown in 1926, gave very good yields of flour. The remainder gave good to medium amounts.

1927 Harvest Wheats (Table 2).

The best wheat tested in 1927 as regards yield of flour was a sample of College Hunter's (X 369) grown at Ashburton Experimental Farm. This gave the excellent yield of 77·7 per cent. flour. Following closely was Goldberry (Hybrid W., X 370), with 77·6 per cent. flour. A sample of the same wheat (X 380) grown this year at Lincoln gave

Table 1.—Milling Tests, 1926 Harvest.

Laboratory No.	Variety.	Locality.	Calculated Weight per Bushel.	Milling Test.			Remarks on Yield of Flour.
				Bran.	Pollard.	Flour.	
W			lb.	Per Cent.	Per Cent.	Per Cent.	
160	Queen Fair	Ashburton	63	10·4	12·2	77·4	Excellent.
156	Yeoman	,,	65	10·9	12·3	76·8	Excellent; easy to mill.
171	White-straw Tuscan	Horrelville	64	12·8	11·5	75·7	Very good.
258	Dreadnought	,,	62	9·4	15·0	75·6	,,
168	Jumbuck	,,	64	8·5	16·2	75·3	,,
152	College Hunter's	Ashburton	60	12·9	11·9	75·2	,,
172	Goldberry (Hybrid W.)	Horrelville	64	10·7	14·1	75·2	,,
158	Major	Ashburton	62	12·6	12·2	75·2	,,
255	Red Marvel	Horrelville	60	11·7	13·6	74·7	,,
257	College Hunter's	,,	63	12·9	12·7	74·4	,,
164	Solid-straw Velvet	Ashburton	58	7·9	17·8	74·3	,,
162	College Velvet	,,	63	11·1	14·8	74·1	,,
161	Velvet Ngapara	,,	64	10·5	15·4	74·1	Very good; easy to mill.
157	Solid-straw Tuscan	,,	62	11·6	14·4	74·0	Very good.
256	Yandilla King	Horrelville	60	14·2	11·8	74·0	Very good; easy to mill.
154	Jumbuck	Ashburton	61	8·8	17·6	73·6	Very good.
166	Marquis	,,	65	12·6	14·0	73·4	,,
259	Quality White	Methven	64	11·5	15·1	73·4	Good.
170	Queen Fair	Horrelville	65	11·6	15·6	72·8	,,
155	Red Fife	Ashburton	61	11·1	16·2	72·7	,,
254	Stand Up White	Horrelville	70	12·7	14·9	72·4	,,
260	Solid-straw Tuscan	,,	65	11·6	16·3	72·1	,,
159	Essex Conqueror	Ashburton	64	16·2	12·3	71·5	Medium.
169	Red Fife	Horrelville	66	14·4	14·4	71·2	,,

Table 2.—Milling Tests, 1927 Harvest.

Laboratory No.	Variety.	Locality.	Calculated Weight per Bushel.	Milling Test.			Remarks on Yield of Flour.
				Bran.	Pollard.	Flour.	
X			lb.	Per Cent.	Per Cent.	Per Cent.	
369	College Hunter's (control) ..	Ashburton ..	63	11·8	10·9	77·7	Excellent.
370	Goldberry	,, ..	63	10·5	11·9	77·6	,,
364	Major	,, ..	64	10·4	12·5	77·1	,,
380	Goldberry	Lincoln College ..	65	11·8	11·4	76·8	,,
382	XI/27	,, ..	64	9·7	13·5	76·6	,,
365	Queen Fair	Ashburton ..	64	5·9	17·5	76·6	,,
363	Trifolium 14	,, ..	60	12·1	11·5	76·4	,,
375	Yeoman II	Lincoln College ..	63	9·1	14·5	76·4	,,
383	XI/83	,, ..	65	9·5	14·2	76·3	,,
376	Biffen II	,, ..	60	12·8	11·4	75·8	Very good.
420	Victor	,, ..	65	13·4	11·4	75·2	,,
367	Essex Conqueror	Ashburton ..	64	11·0	14·0	75·0	,,
371	White-straw Tuscan	,, ..	65	11·5	13·6	74·9	,,
384	XI/206	Lincoln College ..	64	11·2	13·9	74·9	Very good; easy to mill.
381	White Fife x Benefacti 2	,, ..	62	11·4	13·8	74·8	,, ,,
377	Red Fife	,, ..	60	11·8	13·5	74·7	Very good.
361	Solid-straw Tuscan	Ashburton ..	63	10·3	15·4	74·3	,,
374	College Velvet	,, ..	64	11·8	14·2	74·0	,,
419	Pearl	Lincoln College ..	66	13·8	12·4	73·8	,,
366	Marquis	Ashburton ..	66	8·6	17·9	73·5	,,
373	College Hunter's, 1926	,, ..	64	12·9	13·6	73·5	,,
441	"Mixture"	.. ..	..	13·0	13·5	73·5	,,
379	Bell	Lincoln College ..	58	11·6	15·0	73·4	,,
378	College Hunter's	,, ..	62	11·2	16·3	72·5	Good; easy to mill.
421	Tuscan	,, ..	66	7·9	19·8	72·3	Good.
372	Velvet x Solid-straw Tuscan ..	Ashburton ..	62	11·2	16·9	71·9	,,
368	Yeoman	,, ..	64	14·8	13·5	71·7	,,
362	Red Fife	,, ..	65	9·2	19·4	71·4	Medium.
418	Hunter's	Lincoln College ..	64	10·0	19·2	70·8	,,

76·8 per cent. flour. Last year a sample of the same variety gave 75·2 per cent. flour, while the yield was 77·3 per cent. in 1925 and 75·6 per cent. in 1924. There can be no doubt that Goldberry as a rule produces an excellent percentage of flour. Incidentally these consistent yields give an indication of the reliable results that may be obtained from efficient experimental milling. It can be no accident that Goldberry over a series of years has given such a very good flour-yield, but rather the result of essential characteristics manifesting themselves during reasonable experimental milling tests. The strength, or baking-quality, of Goldberry remains to be established.

There are several little-known varieties among the 1927 wheats, as well as two crossbred wheats in the experimental stage, which give excellent yields of flour. A sample of Yeoman II grown at Lincoln is conspicuous with the excellent yield of 76·4 per cent. flour. This is a very encouraging yield, and agrees closely with the sample of Yeoman grown at Ashburton in 1925, which gave 76·8 per cent. flour. This latter flour (W 156), as far as behaviour in the mill and general appearance of the flour goes, was probably the best flour for strength tested in 1926 and 1927.

Among the wheats from the 1927 harvest giving very good yields was the variety Biffen II, from Lincoln College, with 75·8 per cent. flour. Victor, producing 75·2 per cent., is no exception to the rule that this variety may generally be expected to give a good yield of flour; it usually fails, however, in baking-qualities.

Other interesting varieties giving good yields of flour are Essex Conqueror, Red Fife, Velvet, Pearl, and Marquis, all wheats which may also be expected to produce flour of good baking-strength. Those wheats producing less than 72·5 per cent. flour in 1927 may be classified as good to medium, none giving less than 70·0 per cent. flour.

Averages.

The averages for the different districts were as follows:—

	Per Cent. Flour.		Per Cent. Flour.
1926—Ashburton ..	74·4	1927—Ashburton ..	74·7
Horrelville, &c. ..	73·9	Lincoln College ..	74·5

There was a certain tendency, not reflected in the above figures, for the 1927 wheats to give higher flour-yields, nine of the twenty-nine tested being classified as excellent, compared with two of the twenty-three grown in 1926.

Low Temperature Research. — The successful marketing of Empire produce from overseas depends upon no single factor more than upon the skilful development of cold-storage processes (states a recent report of the Empire Marketing Board, London); and research into these processes is also of great importance in its bearing upon the keeping-qualities of the produce of the home supplier. The Low Temperature Research Station at Cambridge under the auspices of the Department of Scientific and Industrial Research has already made contributions to this development which have been gratefully recognized throughout the Empire and which point to invaluable opportunities for their extension. The Board has accordingly approved a substantial grant for the extension of this station at Cambridge, and has given provisional approval to a scheme for the erection of a new station at East Malling, Kent, for cold-storage experiments on a semi-commercial scale.

PASTURE-IMPROVEMENT.

TOP-DRESSING EXPERIMENTS WITH POTASH AND NITROGEN IN AUCKLAND PROVINCE.

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To state that grassland is the mainstay of the New Zealand farmer is only stressing the obvious. The truth of the statement, however, is exemplified more in the North Island than in the South Island, where cereal production and other cash crops occupy an important place in farming. It is particularly true of the northern portion of the North Island, where, with the exception of cob maize, the farmer is dependent almost wholly on his pastures.

In order to establish and maintain good grassland the application of phosphatic manures to the soil is essential. This fact is fairly widely recognized, though manuring of grassland is not so widely practised as is generally supposed. Even in the Auckland Province, where the main crop is overwhelmingly grass, only about one-fifth of the area in grass is regularly top-dressed with fertilizer. This estimate was made recently, and was arrived at after calculating the total amount of phosphate used in the province for top-dressing, and allowing that on the average a dressing of 2 cwt. per acre was applied annually.

In districts where intensive dairying is the main type of farming followed, top-dressing with phosphatic fertilizers is a regular practice. Except on the best soils, much of the country which is now giving profitable returns would not be in first-class pasture were it not for the fact that phosphatic manures have built up soil-fertility so that such a pasture can be maintained.

The sure place now occupied in farming practice by phosphatic top-dressing of grassland, especially in the dairying districts, has attracted the attention of farmers on the wider areas where grazing of sheep and cattle is the chief occupation and the demands on the soil are relatively less than on more intensively farmed country. On these lands the response to phosphates is very marked, and no doubt the good results already attained during the last two or three years will tend to make top-dressing as indispensable to their profitable farming as on the dairying-lands. Farmers have hitherto been relying on the virgin fertility of the soils on the sheep and cattle country, but the natural reserves are certainly showing clear signs of depletion, with deterioration of the pastures, which in turn causes a lowering of the carrying-capacity, followed by diminished returns.

The Department of Agriculture has accumulated a mass of useful information from soil-analysis, from systematic field experiments, and from the experience of farmers in the use of fertilizers on grassland. The comparative values of different phosphates on the market have been widely tested, and fairly definite advice can be given on the use of the different kinds. But the case for fertilizers supplying potash and nitrogen has not been worked out. The opinion has been widely held that nitrogen is not necessary for grassland, as it was considered

economically sound to increase clover-growth by the use of phosphates, the clovers in their turn supplying available nitrogen to be absorbed by the grasses. The recent German experiments on grassland have shown that direct feeding of grasses with nitrogen may be highly profitable. The position taken up is, If nitrogen supplied indirectly by the clovers is so good for the grasses, why not supply the nitrogen direct to the grasses?

Plan of the Auckland Experiments.

In the Auckland Province a series of field experiments have been designed to test this proposition on an economic basis. Trials, using green-weight increases on small-scale plots established in different parts of the province, are being made. In addition a small farm of 50 acres at Manawaru, near Te Aroha, running a milking-herd of thirty dairy cows, is being dressed with sulphate of ammonia, and the measure of improvement in this case will be the increase or otherwise of milk and butterfat returns from the herd over a number of seasons. Similar experiments have been established to test potash. In both cases phosphates, with and without lime, form the basis of the manuring.

These experimental plots are all situated on soils which have been heavily manured with phosphates for many years—up to ten and even twenty years. The contention is that if potash or nitrogen is a limiting factor these soils should tend more to show this fact than other soils not so treated. The trials dealt with in this report refer to Maunu, near Whangarei; Matangi, near Hamilton; and Te Aroha.

The manures used were as follows, the quantity per acre being stated in each case:—

(1) Superphosphate (44/46 per cent.), 3 cwt.
(2) Superphosphate (44/46), 3 cwt., plus sulphate of potash, $\frac{3}{4}$ cwt.
(3) Superphosphate (44/46), 3 cwt., plus dried blood, $\frac{3}{4}$ cwt.

A fourth plot was left unmanured.

The plots were laid down the width of the manure-drill—8 ft. or 9 ft. wide—along the field for a distance of 6 chains. A cross-dressing of 5 cwt. of carbonate of lime per acre was applied at 1-chain intervals, so that the effect of the manures on limed and unlimed pasture could be noted. There were six replications of each treatment, giving twenty-five plots in all.

The plots were closed during the haying season of 1926, and, when cut, a uniform swath was taken along the centre of each plot for a distance of $\frac{1}{2}$ chain, and the green material weighed. Each weighing therefore represents the amount of herbage from $\frac{1}{440}$ acre. The weight per acre has been expressed as tons of hay, by taking the hay weight as being one-third of the green weight.

Farm of F. O. Barge, Maunu.

Soil: Medium volcanic loam; lime-requirement, 4·2 tons per acre (Hutchinson and McLennan method); total phosphoric acid, 0·17 per cent. (top soil dried at 100° C.); available phosphoric acid, 0·018 per cent. Pasture: Cocksfoot, rye-grass, and white clover, with a

certain amount of paspalum and ratstail. History of field: Sown to grass in 1920, with 3 cwt. per acre of equal parts super and blood and bone; in 1922 top-dressed with 2 cwt. super and 1 cwt. lime per acre; 3 cwt. super in 1925. Cut for hay in 1925.

The manures for the present experiment were applied 8th July, 1926, and the field was closed for hay during August. There was no visible difference in appearance of the plots during the growing-period. The crop was cut on 6th December, 1926. Results are shown in the following table:—

Table 1.—Results, F. O. Barge's Farm, Maunu.

Comparison, A versus B.	Number of Compared Plots.	Weight expressed as Tons of Hay per Acre.	Difference in Favour of A (Tons).	Difference Significant (S.) or Non-significant (N.S.).	Cost of Manures (f.o.r. Prices)
Unlimed Plots.					£ s. d.
A. Super	24	4·133	0·305	S.	0 16 10
B. Control	..	3·828	..	..	..
A. Super and potash ..	24	4·175	0·346	S.	1 8 1
B. Control	..	3·829	..	..	..
A. Super and blood ..	24	4·183	0·198	S.	1 7 9
B. Control	..	3·985	..	..	..
A. Super and potash ..	24	4·262	0·124	N.S.	1 8 1
B. Super	..	4·138	..	..	0 16 10
A. Super and blood ..	24	4·115	0·28	N.S.	1 7 9
B. Super	..	4·087	..	..	0 16 10
Limed Plots.					
A. Super	24	4·189	0·198	S.	0 16 10
B. Control	..	3·991	..	..	..
A. Super and potash ..	24	4·188	0·198	S.	1 8 9
B. Control	..	3·990	..	..	..
A. Super and blood ..	24	4·317	0·429	S.	1 7 9
B. Control	..	3·888	..	..	..
A. Super and blood ..	24	4·174	0·46	N.S.	1 7 9
B. Super	..	4·128	..	..	0 16 10
A. Super	24	4·244	0·69	N.S.	0 16 10
B. Super and potash ..	..	4·175	..	..	1 8 9

NOTE.—A difference is regarded as "significant" when the chances (computed by the statistical method) are 30 to 1 or more in its favour.

It will be seen from the table that all the treatments have given substantial weight-increases over no manure, but when the treatments are compared each with the other the differences thus revealed are not statistically significant. In other words, the differences may not be real and due to the effect of the manures. It cannot be said, therefore, with any certainty that any one treatment is better than another at this stage of the experiment, but it would appear that neither the

addition of potash nor of blood to the phosphate has caused any measurable increase in the weight yield.

According to the chemical analysis taken before the dressings were applied, this soil was deficient in available phosphates and only moderately supplied with total phosphates, and it may be that the manuring of the field with phosphates has not reached that stage when it can be supplemented to advantage by the addition of nitrogen or potash.

The aftermath was inspected at various times after cutting, and, although the top-dressed plots were practically indistinguishable one from the other, the check plots showed generally more bare spaces, more weeds of the catsear and hawkweed type, and less clover than the adjoining plots. It was also noticed that a preference was shown by the stock for the limed areas irrespective of the top-dressing used.

Farm of J. A. Clothier, Hungahunga (Te Aroha).

Soil: Consolidated silty peat, overlying heavy clay; lime-requirement, 7·3 tons per acre (Hutchinson and McLennan method); total phosphoric acid, 0·08 per cent.; available phosphoric acid, 0·018 per cent. History of field: Sown to grass in 1923; cut for hay in 1924; top-dressed with 2½ cwt. super per acre in 1924 and 1925.

The manures for the present experiment were applied on 13th September, 1926, the pasture at that time being composed mainly of perennial rye-grass, cow-grass, timothy, and white clover. The crop was cut for hay on 19th January, 1927, and up to the time of cutting there was no marked difference of the herbage in the various plots. Results of the weighings are set out in Table 2. (See next page.)

All the manures, it will be observed, have given increases when directly compared with no manure, and the increase is so appreciable that each treatment repaid the cost of application. An outstanding feature of the results, however, is the increase given by the addition of potash to the phosphatic dressing on the unlimed plots. The increase apparently due to the same manuring on the limed plots is not significant, the odds in favour of the difference being less than 30 to 1, and therefore such increase cannot, with practical certainty, be regarded as being due to the manurial treatment. The soil-analysis indicated that this soil was deficient in total phosphate, yet well supplied with available phosphate. The indicated lime-requirement was very high indeed.

The favourable response to potash in this experiment supports the claim that peat soils need that constituent and respond to applications of it. The application of lime on the peat soil gave a favourable result on all the plots. When treatments are compared, therefore, on the limed areas it will be seen that the influence of the lime has somewhat masked the increase due to potash. In other words, the potash does not appear to have asserted itself so much in the limed as in the unlimed plots; but this can be understood when due allowance is made for the good effects brought about by the lime.

When the aftermath was examined on 24th February the check plots could be easily distinguished, standing out as golden strips of flowering catsear and hawkbit. As the herbage consisted mainly of

Table 2.—Results on J. A. Clothier's Farm, Hungahunga.

Comparison, A *versus* B.	Number of Compared Plots.	Weight expressed as Tons of Hay per Acre.	Difference in Favour of A (Tons).	Difference Significant (S.) or Non-significant (N.S.).	Cost of Manures (f.o.r. Prices).
					£ s. d.
Unlimed Plots.					
A. Super	24	2·265	0·273	S.	0 16 10
B. Control	..	1·992	..	..	..
A. Super and potash ..	24	2·325	0·383	S.	1 8 1
B. Control	..	1·942	..	..	..
A. Super and blood ..	24	2·315	0·415	S.	1 7 9
B. Control	..	1·900	..	..	..
A. Super and potash ..	24	2·574	0·258	S.	1 8 1
B. Super	..	2·316	..	..	0 16 10
A. Super	24	2·214	0·009	N.S.	0 16 10
B. Super and blood ..	..	2·205	..	..	1 7 9
Limed Plots.					
A. Super	24	2·413	0·314	S.	0 16 10
B. Control	..	2·099	..	..	..
A. Super and potash ..	24	2·433	0·293	S.	1 8 1
B. Control	..	2·140	..	..	..
A. Super and blood ..	24	2·454	0·364	S.	1 7 9
B. Control	..	2·090	..	..	..
A. Super	24	2·385	0·069	N.S.	0 16 10
B. Super and blood ..	..	2·316	..	..	..
A. Super and potash ..	..	2·572	0·132	N.S.	1 8 1
B. Super	..	2·430	..	..	0 16 10

cow-grass there was no great difference between the remaining plots, except that the potash plots appeared to be more vigorous and of better colour, and it was noticed that on the first grazing the dairy cows showed a preference for them. The limed plots gave noticeable increases in clover-growth over the check plots.

Farm of W. Ranstead, Matangi.

Soil: Pumiceous loam; lime-requirement, 4·8 tons per acre (Hutchinson and McLennan method); total phosphoric acid, 0·17 per cent.; available phosphoric acid, 0·018 per cent. Pasture: Rye-grass, cocksfoot, crested dogstail, and white clover. History of field: Old pasture; had been top-dressed for seven years at least with 2 cwt. to 3 cwt. of either super or basic super.

The manures for the present experiment were applied on 19th July, 1926. The field was closed for hay in September, and cut on 14th and 15th December. At the time of cutting the check plots could be distinguished from the manured plots quite easily on account of their brown appearance, due to the less amount of clover in the herbage and a greater proportion of rib-grass.

The following table gives the results: —

Table 3.—Results on W. Ranstead's Farm, Matangi.

Comparison, A *versus* B.	Number of Compared Plots.	Weight expressed as Tons of Hay per Acre.	Difference in Favour of A (Tons).	Difference Significant (S.) or Non-significant (N.S.).	Cost of Manures (f.o.r. Prices).
Unlimed Plots.					£ s. d.
A. Super	20	3·298	0·217	S.	0 16 10
B. Control	..	3·191	..	..	..
A. Super and potash ..	20	2·952	0·166	N.S.	1 8 1
B. Control	..	2·786	..	..	..
A. Super and blood ..	25	3·321	0·447	S.	1 7 9
B. Control	..	2·874	..	..	..
A. Super and potash ..	25	3·413	0·067	N.S.	1 8 1
B. Super	..	3·346	..	..	0 16 10
A. Super and blood ..	20	2·752	0·125	N.S.	1 7 9
B. Super	..	2·627	..	..	0 16 10
Limed Plots.					
A. Super	30	2·925	0·360	S.	0 16 10
B. Control	..	2·555	..	..	..
A. Super and potash ..	24	2·791	0·350	S.	1 8 1
B. Control	..	2·440	..	..	..
A. Super and blood ..	30	3·095	0·277	S.	1 7 9
B. Control	..	2·818	..	..	..
A. Super and potash ..	30	3·376	0·364	S.	1 8 1
B. Super	..	3·012	..	..	0 16 10
A. Super	24	2·514	0·002	N.S.	0 16 10
B. Super and blood ..	..	2·512	..	..	1 7 9

The figures show that super plus potash has failed to give any significant increase over no manure on the unlimed plots, but, except for this, all the manures have given good results when compared with no manure. Moreover, the addition of potash to super has given a significant weight-increase over superphosphate alone on the limed plots. This is diametrically opposed to the results secured at Hungahunga. Further trials may clear up this matter.

An examination of the field a few weeks after cutting revealed the fact that the check plots stood out from the rest on account of the seed-heads of rib-grass. Of the manured area the potash plots were grazed the more evenly and closely, while the blood plots showed a good deal of top which had been neglected. When an inspection was made during the winter the limed plots were looking much better than the unlimed, chiefly on account of the white-clover content; and the same observation could be applied to the treated plots when compared with the checks.

General Comments.

While the foregoing results were obtained within five months of treatment, and as yet no definite general conclusions can be drawn, there are a few facts which may be commented upon.

A nitrogenous dressing is generally claimed to stimulate growth and to give greater bulk, especially when applied in spring to the hay crop. Yet at each centre nitrogen in the form of blood has failed to give any appreciable increase. The complete test of these manurial treatments, however, may come later on, when, after further dressings, any change in the herbage has been observed. At two places potash added to the superphosphate has given good results in the first year, and it will be noted that at each of them the soil, according to analysis, was relatively high in the amount of available phosphate prior to the manures being applied. Further, chemical analysis showed that the soils were well supplied with potash.

In every case, with the exception of super and potash on the unlimed plots at Matangi, the pastures have been responsive to the various treatments, and in most cases the increase has been sufficient to cover the cost of the manures. Yet the most striking results were seen in the aftermaths, when, after a few weeks from the time of cutting, the check plots were masses of flowering weeds. It would appear that under ordinary circumstances, when a pasture is closed for hay, those weeds of the catsear type which are not shade-loving and are kept subdued by the hay crop assert themselves on the shady conditions being removed. Yet spring top-dressing seems to prevent this, probably on account of the increased clover content of the pasture "bottom."

These experiments will be continued during the next season as far as possible, and it is to be hoped that further useful data will be obtained from the composition of the herbage as well as from the hay weights.

We tender thanks to Messrs. Barge, Clothier, and Ranstead for their valuable co-operation with the Department. We also acknowledge the help given by Mr. A. H. Cockayne, Director of the Fields Division, in planning the trials, and by other members of the Division in securing the experimental results.

Deficiency Diseases of Live-stock.—The Empire Marketing Board remarks in a recently issued report: "One of the gravest yet most obscure handicaps to the rearing of flocks and herds in several parts of the Empire is the deficiency of minute quantities of mineral salts in their pastures. This lack hinders the growth of animals, and even causes them to perish from malnutrition. Following pioneer work done in various parts of the Empire—and notably in South Africa—research into this question, the importance of which was brought to the Board's notice at an early stage by the Committee of Civil Research, is already being pursued upon a concerted plan, with funds provided partly from the Empire Marketing Fund and partly from local public or private sources, at the Rowett Institute, Aberdeen, in the highlands of Kenya, in New Zealand, and in Australia. No better example could be offered of the value of scientific 'team work' throughout the Empire."

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, 1926–27 SEASON.

J. W. DEEM, Instructor in Agriculture, Wanganui.

THE early part of the season at Marton was very wet, preventing agricultural operations being carried out in a satisfactory manner. Good seed-beds could not be prepared on the heavy soil of the Experimental Area, and sowing had to be done under very difficult conditions; portions of areas sown in cereals were subsequently swamped out by heavy rainstorms. About New Year the weather took up, and harvest operations were conducted under very satisfactory conditions for this district. The rainfall for the year was as follows:—

Table 1.

Month.	Number of Wet Days.	Month's Rainfall.	Average Rainfall, 1916 to 1927.	Month.	Number of Wet Days.	Month's Rainfall.	Average Rainfall, 1916 to 1927.
1926.		In.	In.	1927.		In.	In.
July ..	10	5·57	39·68	January ..	10	2·22	40·45
August ..	11	3·75	39·40	February ..	8	2·58	40·21
September ..	9	2·86	40·02	March ..	14	4·82	40·61
October ..	18	8·17	38·57	April ..	12	3·52	40·34
November ..	15	5·38	40·10	May ..	11	3·96	40·34
December ..	8	3·18	40·50	June ..	14	3·50	49·51

Arable Crops.

The growing of cash crops is being gradually reduced at the Marton Area, each year more of the land being devoted to experimental work with grasses, clovers, and pasture top-dressing. The total area under crop in the 1926–27 season was 20 acres, 5 acres of this being in oats, 8 acres in wheat, 2 acres in barley, and 5 acres in swedes and chou moellier.

Cereals.

The wheat variety grown was Jumbuck, and, although large patches were drowned, it threshed out at the rate of 34½ bushels to the acre. This wheat does well in the Marton district, but suffers from birds.

One bushel of Spratt Archer barley, selection 37/6, was procured from England through the courtesy of Captain H. Hunter, School of Agriculture, Cambridge. This was sown on ⅕ acre on 28th September, 1926, harvested 4th February, 1927, and threshed out of stook on 17th February, yielding 22⅕ bushels, or at the rate of 68⅖ bushels per acre, of very nice quality barley. The germination was fair, and the plants stooled well. Portion of this barley has been sent to the Fields Division at Christchurch, to be further tested out in Canterbury. The rest will probably be sown on the Marton Area in the season now commencing.

The oat crop consisted of a test between College Algerians and ordinary South Island and Australian Algerians. The College strain stooled out best, and appeared to give the better crop right through. The material from each area was stacked separately for cutting into chaff, but up to date of writing this has not been done.

Swedes.

A test was made of seventeen varieties. The crop was sown on 22nd December in drills 28 in. apart, thinned and intercultivated, the manuring being superphosphate at 3 cwt. per acre. The field on which the crop was grown is very stiff land, and was very wet right up to and for two or three weeks after sowing, when an acute dry spell set in and the soil set very hard. Consequently the crop did poorly and the yields were light. No swedes in the locality did well. The crop was weighed on 18th May, with the following results :—

Table 2.

Variety.	Number of Roots per Chain.	Weight per Acre.	Remarks.
		T. cwt.	
Studsgaard Itamme..	76	10 12	2 per cent. of club-root ; quality poor.
Hernsnaps Itamme ..	84	11 2	No disease ; roots small, but cut sound.
Family No. 4 ..	76	13 18	No disease ; when cut going dark in centre.
Wiboltt's Danish Giant	64	21 4	Very sound roots ; cut well.
Bangholm Klank ..	72	17 8	No disease ; quality fair ; cut very nicely.
Sutton's A.. ..	76	18 3	No disease ; a few nodular roots ; cut well.
Sutton's B.. ..	64	23 4	No disease ; roots well grown, a few with slight nodular growth ; cut well.
Sutton's C.. ..	56	17 3	No disease ; roots rather long shape ; cut very nicely.
Bangholm Pajbjerg	81	16 13	No disease ; cut very nicely.
Sharpe's Great Scott	72	13 18	No disease ; cut nicely and clean ; very yellow.
Sharpe's Supreme ..	76	21 4	Green top ; sound, and cut well.
Sharpe's Paragon ..	88	29 16	Rather white flesh ; sound ; cut very nicely.
Sharpe's A1 ..	88	25 15	No disease, but going off in centre.
Sharpe's Ne Plus Ultra	80	20 16	Going off a bit in centre, otherwise sound.
Sharpe's Coronation	84	15 3	Light-green top ; no disease.
Sharpe's Standard ..	80	17 13	20 per cent. of club-root ; sound roots cut well.
Sharpe's Premier ..	56	21 4	Well-grown roots, but showing dark in centre when cut.

A small manurial experiment was also carried out with swedes to test the proprietary fertilizer Sulfurophosphate against superphosphate, the rate in each case being 3 cwt. per acre. The seed was sown in drills 28 in. apart, thinned, and intercultivated. Two varieties of swedes were used, and weights were taken on 16th May. Results are shown in the following table :—

Table 3.

Variety.	Manure.	Number of Roots per Chain.	Weight per Acre.	Remarks.
			T. cwt.	
Bangholm Pajbjerg	Superphosphate	81 (average root, 1·63 lb.)	17 8	Roots cut nicely; no disease.
Ditto	Sulfurophosphate	63 (average root, 1·9 lb.)	15 15	No disease; roots cut nicely; one or two showing slight nodular growth.
Bangholm Klank	Superphosphate	72 (average root, 2 lb.)	16 13	No disease; cut well; crop light.
Ditto	Sulfurophosphate	80 (average root, 1·44 lb.)	15 8	Roots rather smaller than superphosphate lot; no disease; cut well.

It will be noticed that the germination was about equal, but superphosphate gave the heavier crop; no disease was present.

Clovers and Grasses.

The areas under clover tests have been extended, and now comprise various strains of both white and red clovers. In the white clovers the supremacy of imported wild white and Canterbury white over ordinary imported white is more apparent than ever. The two former have now grown into a close sward, covering the whole of the ground and producing green succulent fodder practically all the year round; while the area sown with ordinary imported has become very patchy, showing large patches of water-couch and other inferior herbage, and not producing anything like the amount of fodder yielded by the Kentish imported and the Canterbury. If it were not for the fact that the ordinary imported reseeds itself to some extent, the area sown in it would be carrying very little. This clover rushes up to flower rapidly and matures a quantity of seed, then for quite a long period is more or less dormant, producing practically no feed. The Canterbury white flowers about three weeks later than the ordinary, and taking 100 as the percentage of flowering on the ordinary imported the percentage on the Canterbury would be in the vicinity of 30 per cent., while in the imported wild white it would not be more than 10 per cent., and only a small proportion of this appears to set seed. During the past two seasons an endeavour has been made to secure seed from the imported wild white, but owing to its shyness in flowering we have not been successful.

An area has also been sown down in perennial rye-grass, 15 lb; cocksfoot, 6 lb.; and imported wild white clover, 3 lb. per acre, to test the value of this mixture for permanent pasture. On half the area very-old-pasture Hawke's Bay rye-grass seed was used, and on the rest, standard Canterbury. This will provide an experiment to determine the lasting-value of old-pasture rye-grass seed, costing 12s. per bushel, against the standard at 6s.

A 10-acre field has been sown in red clover and rye-grass to test out the feeding and lasting qualities of ordinary imported red clover, New-Zealand-grown, Vale of Clywd, Cornish Marl, and genuine Montgomeryshire late-flowering red. Five acres were sown on 8th April,

FIG. 1.—CLOVER AREAS, SHOWING DIFFERENCE BETWEEN NEW ZEALAND WHITE (LEFT) AND ORDINARY IMPORTED WHITE (RIGHT).

FIG. 2.—CLOVER AREAS, SHOWING DIFFERENCE IN FLOWERING BETWEEN IMPORTED WILD WHITE (LEFT) AND NEW ZEALAND WHITE (RIGHT).

[*Photos by H. Drake.*

1926, and the sowings repeated on the adjoining 5 acres on 24th November. All the clovers, with the exception of ordinary imported red, came away well. The latter established poorly as compared with the others, both in the autumn and spring sowings, although the seed sown had given a laboratory test of over 90 per cent. germination. The Montgomeryshire red and Vale of Clywd appear to be very similar, both varieties having a definite spreading habit and being fully six weeks later in flowering than the ordinary imported and New-Zealand-grown varieties. Owing to this lateness in flowering the Montgomeryshire red and Vale of Clywd have a much longer growing-period and appear to produce a great deal more feed. During the past winter these two varieties have grown more or less right through, and provided quite a lot of fodder. To the casual observer the area under these clovers, when compared with the area under ordinary red, would suggest that the former had been heavily dressed with fertilizers and the latter left untreated. As a matter of fact, the whole field has been treated in exactly the same manner. Further supplies of Montgomeryshire late-cut clover-seed are under order, and it is proposed to sow additional areas in this clover during the present season. It is also hoped that some seed will be saved from the present area next autumn.

Small plots of pure sowings of the various clovers and rye-grasses under test have also been established, also plots of several new strains of other grasses, including a plot of *Phalaris stenoptera* from seed imported from America by Mr. W. J. Polson, president of the New Zealand Farmers' Union. Several New Zealand specialists who have examined this grass declare that it is identical with a grass that has been grown in New Zealand for a number of years under the name of *Phalaris bulbosa*, or Harding grass.

Pasture Top-dressing.

The experiments referred to in last year's report (*Journal*, August, 1926) have been continued, and a further series have been laid down to test Seychelles guano against superphosphate with and without muriate of potash; also to test Seychelles guano, finely ground and standard Nauru phosphate, Sulfurophosphate, basic slag, and superphosphate against one another. Some of the 1926–27 results are very interesting. Table 4 gives the results, in weight of green material, of five cuts for hay in Field 4 to test ordinary against finely ground Nauru phosphate; Table 4*a* records a test between super, Nauru, and Nauru plus sulphur.

Table 4.

Treatment per Acre.	Total Yield per Acre (Five Cuts).	Total Yield per Acre from Adjacent Controls	Increase due to Manure.
	T. cwt.	T. cwt.	T. cwt.
Ordinary Nauru phosphate, 80 per cent. fineness, 3 cwt.; applied 6/6/24 and 28/5/26	38 3	33 5	4 18
Special Nauru phosphate, 120 per cent. fineness, 3 cwt.; applied 6/6/24 and 28/5/26	38 4	33 19	4 5

Table 4a.

Treatment per Acre.	Total Yield per Acre (Five Cuts).	Total Yield per Acre from Adjacent Controls.	Increase due to Manure.
	T. cwt.	T. cwt.	T. cwt.
Superphosphate, 3 cwt.; 20/9/24 and 28/5/26 ..	37 1	31 17	5 4
Nauru phosphate, 3 cwt.; 20/9/24 and 28/5/26	34 13	30 7	4 6
Nauru phosphate, 3 cwt., and sulphur, 84 lb.; 20/9/24 and 28/5/26	34 2	29 15	4 7

From Table 4*a* it will be seen that super has given slightly better results than Nauru, but this was due to increased yields in the first two seasons. In 1926–27 the Nauru gave a little better increase than super. It will also be noticed that the application of sulphur in combination with Nauru apparently had no effect on the yield.

The results of a test between Rhenania phosphate, basic slag, and superphosphate are given in the next table:—

Table 5.

Fertilizer.	Date applied.	Yield per Acre (Green Weight).
		Tons.
Rhenania phosphate, 2 cwt. per acre	29/5/26	9·80
Basic slag, 2 cwt.	29/5/26	9·94
Superphosphate, 2 cwt.	28/7/26	9·55

The weights, it will be seen, are about equal. Rhenania phosphate represents an attempt to produce an artificial slag, and contains 25 per cent. phosphoric acid. Cross-sections of this field were top-dressed with 30 per cent. potash salts at 1 cwt. per acre. The average weight from the areas that had potash works out at 9·63 tons per acre, while those that had no potash average 9·80 tons, or 0·174 tons in favour of no potash. This difference is not significant, but goes to further substantiate the previous findings that potash has no effect on the weight of material grown on this farm. It may, of course, improve the quality.

Brice's Section, Field 3a.

This area consists of some town sections that have been in grass for over thirty years. When taken in hand in 1921 the land was carrying a poor covering of *Agrostis stolonifera* (water-couch), and producing practically nothing, whereas at the present time the top-dressed pastures are first class and would carry from three to four sheep per acre, while the control would carry about 1 sheep and do it very poorly. Table 6 gives the manures that have been applied since 1921, their cost, and the weight of grass from one cut per year for the past three years. It will be noticed that the Nauru phosphate in trial No. 7 shows much poorer results than in 2, 3, and 4. There is a doubt about the material of the first application. Although supplied as Nauru phosphate, we surmise that it must have been a mixture of half Nauru

FIG. 3.—TOP-DRESSED PASTURE PLOTS IN FIELD 3A.
Nauru phosphate on right; control (no manure) on left.

FIG. 4.—TOP-DRESSED PLOTS IN FIELD 4A.
Lime and super on right; control on left.

and half finely ground carbonate of lime, and as the latter has a depressing effect on the action of Nauru this might account for the poor showing on this area.

Table 6.

Treatment per Acre.	Total Green Weight (Three Years).	Increase over Control.	Cost of Treatment.
	T. cwt.	T. cwt.	£ s. d.
(1) Lime, 1 ton, 9/8/21; super, 2 cwt., 9/8/21, 11/8/24, 28/5/26	19 18	16 2	2 16 0
(2) Bone char, 4 cwt., 9/8/21; special Nauru, 4 cwt., 11/8/24, 28/5/26	14 9	10 13	3 12 0
(3) Walpole Island phosphate, 4 cwt., 9/8/21; Nauru phosphate, 4 cwt., 11/8/24, 28/5/26	14 3	10 7	3 12 0
(4) Nauru phosphate, 4 cwt., 2/11/22, 11/8/24, 28/5/26	14 3	10 7	3 12 0
(5) Control (no manure)	3 16	..	..
(6) Basic slag, 4 cwt., 14/7/21, 11/8/24, 28/5/26	12 15	8 19	3 18 0
(7) Nauru phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26	9 18	6 2	3 12 0
(8) Ephos phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26	10 8	6 12	4 4 0

Moss's Section, Field 4a.

This area consists of several acres of town sections that have been down in pasture for over thirty years, and, like the control in Field 3A, carried a poor covering of *Agrostis stolonifera* when taken in hand two years ago.

The following table gives details of hay weights:—

Table 7.

Treatment per Acre.	Hay Weight per Acre (Two Years).	Hay Weight per Acre of Adjacent Controls.	Increase.	Cost of Treatment.	Cost per Ton of Increase.
	T. cwt.	T. cwt.	T. cwt.	£ s. d.	£ s. d.
Lime, 1 ton, applied 27/7/25 ..	1 14	1 12	0 2	1 0 0	..
Lime, ½ ton, 27/7/25	1 15	1 11	0 4	0 10 0	..
Lime, ½ ton, 27/7/25; super, 3 cwt., 27/7/25, 28/5/26	6 2	1 6	4 16	2 9 0	0 10 2½
Super, 3 cwt., 27/7/25, 28/5/26 ..	4 18	1 14	3 4	1 19 0	0 12 3¾
Basic super, 3 cwt., 27/7/25, 28/5/26	3 13	1 17	1 16	1 16 0	1 0 0¼
Slag, 3 cwt., 27/7/25, 28/5/26 ..	5 17	1 10	4 6	1 16 0	0 8 3
Nauru, 3 cwt., 27/7/25, 28/5/26 ..	5 1	1 14	3 7	1 16 0	0 10 8¾
Super, 1½ cwt.; blood and bone, 1½ cwt.; 27/7/25, 28/5/26	3 14	1 19	1 15	2 8 6	1 6 6¼
Super, 1½ cwt.; blood and bone, 1½ cwt.; sulphate of potash, ¼ cwt.; 27/7/25, 28/5/26	4 8	2 3	2 5	2 16 6	1 5 11
Super, 3 cwt., 27/7/24, 28/5/26; nitrate of soda, 1 cwt., 7/10/25, 13/10/26	7 9	2 5	5 4	4 9 0	0 17 0¾

By weight the super and nitrate-of-soda plot has given the largest increase, due to the excellent rejuvenation of grasses of the rye-grass and cocksfoot type on this plot, indicating that if one were going to

top-dress this class of pasture it might pay to give an application of nitrate of soda the first year. The basic slag has given the cheapest increase, and the quality of the material on this plot is also very fine. The lime and super, super, basic super, and Nauru plots are all very good. The 1½ cwt. super and 1½ cwt. blood and bone, and the 1½ cwt. super, 1½ cwt. blood and bone, and ¼ cwt. sulphate of potash have given the most costly increase, due to the inclusion of the blood and bone and potash.

Strips were also top-dressed across this field with kainit, 2 cwt. per acre, applied on 27/7/25 and 28/5/26, and 30 per cent. potash, 1 cwt. per acre, 28/7/26, but neither have so far shown sufficient increase to warrant the application of these fertilizers.

It is not proposed to apply further dressings of phosphates to this field at present, but the lasting effects of the various phosphates will be observed for a year or two longer. The increased weight on most of the plots has been brought about chiefly by the increase in clovers, but the results from the super and nitrate-of-soda plot are so striking that it has been decided to top-dress cross-sections over all the plots with nitrate of soda and sulphate of ammonia in the current year and note results.

General.

The total area of the farm is 63 acres, of which last season 20 acres were in crop and 16 acres were cut for hay twice and 5 acres once. In addition the area carried on an average approximately 1½ sheep per acre for the whole season, and could have done very much better had sheep been available when required. No sheep were on the farm in December, and very few in January and February.

COPPER-SULPHATE POISONING IN SHEEP: A WARNING.

SEVERAL instances have recently come under notice of mortality in hoggets and in grown sheep through drenching the animals with copper sulphate for stomach-worms. The drench in each case had been made at a strength of 2 to 2½ per cent., instead of from 1 to 1¼ per cent., the correct strength. Also in each case mustard had been added. Mustard is probably used with the idea of stimulating the action of the bowel, but it must be remembered that when hoggets require a drench for parasites their stomach and intestines are already inflamed, and the action of mustard will still further inflame the surface of those organs.

The correct strength for copper sulphate for use in sheep is a 1 to 1¼ per cent. solution—that is, 1½ oz. to 2 oz. per gallon of water. Not more than the 2 oz. per gallon should be used, or the solution will be over strength. Dosage of the 1¼-per-cent. solution should be employed as follows: Sheep, 3 oz.; hoggets, 1½ oz. to 2 oz.; lambs, 1 oz.

For effective treatment of worms the animals should be starved overnight, and not hurried out on to grass for several hours after dosage.

—*Live-stock Division.*

PARASITES OF THE PEAR-MIDGE *(Perrisia pyri)*.

REPORT ON THE 1926 CONSIGNMENTS FROM EUROPE.

D. MILLER, Entomologist, Biological Laboratory, Wellington.

THE work of establishing pear-midge parasites in the midge-infested areas of New Zealand was continued during the 1926-27 season. Arrangements had been made with the Imperial Bureau of Entomology, London, for Dr. R. C. Fisher to secure consignments of parasitized midge larvæ from July to October, 1926.* This material, obtained in France and England, was carried during transport to New Zealand in ships' vegetable-chambers. In all there were five consignments, as follows :—

Table 1.

Consignment.	Place and Month collected.	Date received in New Zealand.
1	Chelmsford and Bedford ; July	August 27th.
2	Versailles, Châtenay, and Angers ; July	September 6th.
3	Versailles, Châtenay, and Chelmsford ; August ..	October 16th.
4	Versailles and Angers ; September	October 30th.
5	Versailles and Châtenay ; October	December 3rd.

The parasitized material was packed in damp moss placed in small wooden boxes, or in tins having the lids sealed with paper. The material as a whole arrived in good condition ; but there was considerable variation in the moisture present in the different boxes, varying from dry to moist and very moist. In all cases where the very moist condition obtained the material was from the tins with paper-sealed lids.

HANDLING IN NEW ZEALAND.

On arrival in New Zealand all the consignments, except the fifth, were placed in cool storage, from which the material was periodically removed as required. As shown in Table 1, the first two consignments arrived during August and early September, before the spring midges emerged in the field. In the first week of September leaves began to develop on the pear-trees, and on the 17th of that month the first midge was noted ; by the 28th midges were common both in Auckland and Nelson, when the spring infestation had definitely commenced. With first sign of leaf-movement a batch of the first consignment of parasitized material was removed from cool storage and placed in emergence-boxes. Table 2 gives the history and average temperature of the several consignments under cool-storage conditions. To the periods of cool storage must be added in each case the period between leaving London and reaching New Zealand, which was practically the same with all consignments, though the actual average temperatures of the ships' vegetable-chambers are not known (approximately between 40° and 50° F.).

* An article by Dr. Fisher, giving an account of this work, was published in last month's *Journal*.

Table 2.

Consignment.	Batch.	Placed in Storage.	Removed from Storage.	Total Time in Storage (Days).	Average Daily Temperature.
1	First ..	27/8/26	7/9/26	11	41·0° F.
	Second ..	27/8/26	23/9/26	27	41·0°
2	First ..	6/9/26	23/9/26	17	43·0°
	Second ..	6/9/26	29/9/26	23	43·0°
	Third ..	6/9/26	19/10/26	43	44·85°
3	All ..	16/10/26	19/10/26	3	42·5°
4	All ..	30/10/26	20/11/26	21	44·0°
5	All ..	Not cool-stored	..	..	..

EMERGENCE OF PARASITES.

These 1926 consignments gave good results, a greater average number of parasites being secured than from the 1925 material. Table 3 sets out the percentages of parasites (both *Platygaster* and others) secured from the material collected in the respective localities for the five 1926 consignments, and also the condition in which the material of each consignment arrived in New Zealand. It will be noted that the first three consignments have been classified according to locality and condition into two or more batches, and some of the latter into lots.

Table 3.

Consignment.	Batch and Lot.	Locality.	Platygaster.		Number of Capsids.	Number of Chalcids.	Condition.
			Per Cent. of Total.	Average Per Cent. per Box.			
1	First ..	Chelmsford ..	6·45	0·54	6	2 ♀	Moist.
	Second ..	Bedford ..	4·03	0·34	0	0	Moderately moist
2	First *a* ..	Versailles ..	1·61	0·54	0	2 ♀	Comparatively dry.
	First *b* ..	Versailles ..	9·68	2·42	0	2 ♀ + 1 ♂	Very moist in tins.
	Second ..	Versailles ..	3·22	1·61	0	0	Moist.
	Third *a* ..	Versailles, Châtenay, and Angers	0	0	0	0	Very dry.
	Third *b* ..	Versailles ..	6·45	3·22	0	0	Very moist in tins.
	Third *c* ..	Versailles ..	0	0	0	0	Very moist in tins, and midges in abundance.
3	First ..	Versailles and Châtenay	58·25	3·64	12	4 ♀ + 1 ♂	Very moist.
	Second ..	Chelmsford ..	4·84	1·61	0	0	Very moist.
4	..	Versailles and Angers	6·45	0·32	0	0	Very moist.
5	..	Versailles and Châtenay	0	0	0	0	Very moist.

♂ = Male; ♀ = Female.

Since the number of boxes in each consignment varied, the average percentage of *Platygaster* emergence from the individual boxes in each consignment was taken as a basis to arrive at an idea as to what period of the year and what locality gave the best results. The data gained

by this method, though necessarily approximate, since the quantity of midge-infested material in each box would not be constant, agree very closely with Dr. Fisher's observations made on the controls kept at Oxford.

INFLUENCE OF MOISTURE ON PLATYGASTER EMERGENCE.

An important factor which would materially influence the emergence of *Platygaster* is moisture. As seen in Table 3, the very moist material in tins (consignment 2, first batch, lot *b*, and third batch, lot *b*) gave a much higher emergence than the others of the same consignment, while very dry material (consignment 2, third batch, lot *a*) gave no emergence at all. On the other hand, certain material (consignment 2, third batch, lot *c*), though very moist and in tins, gave no parasites of any sort, but an abundance of midges. In this last case apparently none of the midge larvæ was parasitized. In regard to consignment 5, it would appear that parasitism does not occur, or only to a very little extent, during October. Lack of moisture in this case could not have been the cause of no emergences, since the material was very moist and in good condition.

The best results, therefore, were secured from the moist to very moist material, the retention of sufficient moisture being an important factor, while the dry material gave few or no parasites or even midges. The best type of container for conserving moisture was the tin with paper-sealed lid. Wooden boxes allowed too great an evaporation unless completely wrapped in waxed paper (which has been found effective in the transport of blow-fly parasites).

INFLUENCE OF COOL STORAGE ON PLATYGASTER.

Concerning the influence of cool storage upon consignments 1 to 4, reference to Table 2 shows that the average daily cool-storage temperature at which the consignments were held varied from 41° F. to 44·85°, while the minimum period was 11 days and the maximum 43 days.

In the case of the first consignment the first batch, held for 11 days at 41°, gave a somewhat higher emergence (see Table 3) than the second batch, held for 27 days at the same temperature. The slight variation in emergence may have been due to other factors than cool storage, such as variation in moisture, or to the degree of parasitism in the two localities where material was collected (Chelmsford and Bedford).

The second consignment was divided into three batches, the first being held for 17 days at 43°, the second for 23 days at 43°, and the third for 43 days at 44·85°. In lots *a* and *b* of the first batch, both held for 17 days at 43°, the much lower emergence (0·54 per cent.) of lot *a* was no doubt due to the comparatively dry state of the material and not to temperature, since lot *b* (very moist and in tins) gave an emergence of 2·42 per cent. In the case of the second batch, held for 23 days at 43°, the emergence was 1·61 per cent., and here, where the moisture was favourable, this reduction might be ascribed to the longer period in cool storage, but a consideration of the third batch apparently contradicts this. The third batch was held for apparently a much longer period than the first and second (namely, 43 days), though at a slightly higher average temperature (44·85°). Nevertheless the

highest emergence percentage (3·22 per cent.) secured from the second consignment was from lot *b* of the third batch, the material of which was very moist. On the other hand, lot *a* of this batch contained very dry material and gave no emergences. It would appear, therefore, that lack of moisture, or state of parasitism, and not prolonged cool storage, was the factor influencing emergence, material in each lot having been collected at the same time from the same locality.

Owing to some of the material of the third consignment having been collected at Versailles and some at Chelmsford this consignment was divided into first and second batches respectively, and held in cool storage for three days at 42·5°. On this consignment being opened on removal from storage adult midges and parasites were found alive. Of all the consignments, the third gave the highest average emergence—5·25 per cent. The influence of cool storage, during both voyage and three days in New Zealand, apparently had had no serious influence on the ultimate results, this consignment being very moist and in a good condition. It will be noted (Table 3) that the percentage of emergence from the second batch (1·61) was much lower than that from the first (3·64), but this was perhaps due to the locality from which the material of the second batch had been collected.

The fourth consignment was held in cool storage for 21 days at an average temperature of 44° and gave an emergence of 0·32 per cent. It is probable, however, that the main factor in this rapid drop in emergence was due to the lateness of the season (September) when the material was collected, the conditions of moisture in the packing being favourable.

The fifth consignment, collected in October, was not placed in cool storage and gave no emergences, though the moisture conditions were good. The lateness of the season was no doubt the main factor in this reduction, as in the case of the fourth consignment.

The very high emergence of the third consignment and the very low emergence of the fourth consignment might be ascribed to the influence of brief cool storage in the former and prolonged cool storage in the latter. On the other hand, in the second consignment lot *b* of the third batch gave a higher emergence, though held in cool storage for 43 days, than lot *b* of the first batch, held for 17 days, the conditions of moisture and locality being equal in both cases. Again the fifth consignment, not held in cool storage, gave no emergences. It would seem that cool storage, at least up to the point to which the first four consignments were subjected, did not seriously influence the percentage of *Platygaster* emergence.

PERIODIC EMERGENCE OF PLATYGASTER.

A consideration of the facts as set out in Table 3 shows that the percentage of emergence increased from the first consignment, through the second (both collected in July), to the third (collected in August), which latter gave the maximum number of *Platygaster*. In the case of the fourth consignment (collected in September) the number of *Platygaster* secured had dropped to below that of the first consignment, and from the fifth (collected in October) no parasites were secured, and very few midges.

It may be concluded from the foregoing that the best period (in England and France) for collecting material parasitized by *Platygaster* would be during July and August, and to a less extent in September. There is no doubt that the percentage of emergences secured from the July material would have been much higher but for some of the material being very dry when it reached New Zealand. It appears also that October is too late in the season for collecting material.

LOCALITY EMERGENCES OF PLATYGASTER.

Considering the *Platygaster* secured from the first three consignments (see Table 3): In the case of the first consignment—which was collected in England, at Chelmsford and Bedford—there was not much difference in the number of parasites secured from the two localities. The condition of the material from both localities was much the same, except that the Bedford material was slightly less moist than that from Chelmsford. The second consignment (collected during the same month as the first) was secured in France, and gave a higher average emergence, where the moisture conditions were favourable, than did the English material. A further interesting case for comparison is afforded by the third consignment, collected in August—some from France and some from England. Here, again, the moisture conditions being equal, the emergence from the English material was lower (about half) than that from France. From this it may be inferred that material collected in England during 1926 was less highly parasitized than that from France, the time of collecting and the moisture conditions being equal. Owing to variation of moisture conditions no definite conclusions can be drawn as to the localities in France from which the most highly parasitized material was secured, except in the case of Versailles and Châtenay.

PERCENTAGE OF SEXES OF PLATYGASTER.

A very noticeable feature was that a much greater number of female than male *Platygaster* emerged from all consignments: from records kept 33·33 per cent. of those secured were males and 66·67 per cent. females.

CHALCIDOIDS AND CAPSIDS.

In all, twelve chalcidoids (ten females and two males) were secured from the first, second, and third consignments, both from the English and French material; while from the first and third consignments —English and French—eighteen capsids emerged.

Summary.

From July to October, 1926, five consignments of parasitized pear-midge material were collected in England and France. These, on the whole, arrived in New Zealand in good condition. After arrival all but the fifth were held in cool storage for varying periods.

It was found that the greatest number of *Platygaster* were secured from the French material, especially from Versailles and Châtenay, and that July and August were apparently the best months for securing parasitized midge larvæ.

It was also found that the presence of sufficient moisture was a fundamental factor influencing the parasites, and that dry material

gave very poor results. The best type of container was the tin with a paper-sealed lid, or wooden box wrapped in waxed paper. Cool storage, to the point to which the material was held in New Zealand, apparently did not influence the percentage of *Platygaster* emerging, the main influencing factors being locality, month of collecting the material, and moisture.

A much greater number of female than male *Platygaster* were secured —66·67 per cent. and 33·33 per cent. respectively.

A number of chalcidoids and capsids were secured from both the French and English material.

INTERMEDIATE HOST OF LIVER-FLUKE IN NEW ZEALAND.

RECORDED AS THE COMMON WATER SNAIL.

C. S. M. Hopkirk, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

With regard to the presence of liver-fluke (*Fasciola hepatica*) in a portion of the North Island, an investigation has recently been carried out in the Hawke's Bay District for the purpose of determining what is the actual intermediate host of the fluke larva in this country.

Thomas, working in England, showed in 1883 that the sporocystic, redial, and cercarial stages of the fluke passed through a fresh-water snail, *Limnaeus truncatulus*, but this snail is not found in New Zealand. McKay, in New South Wales, proved *Limnaea brazieri* to be the intermediate host. In order to gain some idea of what species of water snails might be encountered in Hawke's Bay creeks, large amounts of watercress with snails adherent were examined. Unlike the experience of examination of similar material in Australia, species were few in number, but the representatives of species were frequently present in very large numbers. In the swifter-flowing creeks, and occasionally in the more open swamps, *Potamopyrgus antipodum* was the chief snail present. This variety is hard-shelled and difficult to crush between the fingers. A second snail was also found in the moving water, *Myxas arguta* (Hutton), formerly known as *Amphipeplea arguta*.

In the swamps where the water was fresh and where watercress was in evidence the softer-shelled snails lived in large numbers. Of these *P. antipodum* var. *zelandeae* was by far the most common. A few snails considered to be *P. corolla* var. *Salleana* were also noticed. A new species of *Planorbus* was found in a limestone swamp, and was named by Mr. H. J. Finlay, of Dunedin, to whom specimens were sent for identification, *Planorbus benhami*. Unfortunately, this particular swamp has since been completely drained, and further specimens have not been procurable.

By crushing snails out on glass slides it is possible to see the fluke larvæ moving about in the debris. The mother redia may be seen with the naked eye, but a low power of the microscope is required for cercarial forms. Four distinct species of cercariæ have been found

frequently: (1) A bifid-tailed variety, very fast moving and comparatively small; (2) an active variety bearing a spined tail; (3) an eyed form very similar to the cercariæ of *Fasciola*; (4) the cercariæ of *F. hepatica*.

All of these forms were found in the same species of snail, *P. antipodum* var. *zelandeae*, very possibly because of their thinner shell, which is so much more easily attacked, and because the swamp habitat of this snail is more conducive to parasitism. Snails received all the year round at this Laboratory from affected streams and swamps showed that the cercarial forms were present throughout the spring until December, but since then no larval stages have been found. Two reasons would appear to combine to cause this state—the facts (1) that warm weather appeared early in Hawke's Bay last year, and (2) that the season became very dry following a drought in the preceding year, when swamps had been thoroughly dried out. It would seem that the severe conditions obtaining in the preceding year had necessitated the killing-off of a greater proportion of sheep than usual in the district, and that sheep affected with fluke had died before the spring flush of grass in 1926. Snails were fewer, and with the early warm weather the cercariæ had encysted on the swamp-weeds correspondingly early. Sheep had not fed of necessity on the swamps until the autumn, and so had picked up the fluke in small numbers then. There was not the adult-fluke infestation of sheep to the same extent, and fewer eggs were passed than usual from the sheep. That, combined with a greatly lessened swamp area and number of snails to propagate the fluke, made it impossible to find the larval stage in the many thousands of snails examined.

Experimental work of hatching the eggs was easily carried out in a 22° C. incubator, the eggs hatching into fast-swimming miracidia in seventeen days, provided direct sunlight was brought to bear on the dishes on the seventeenth day. It was not possible, however, to induce these miracidia to become sporocysts, because it was found impossible to get the snails to live in the Laboratory in the aquaria set aside for them. Miracidia appeared to be attracted by the snail, but under the microscope were not seen actually boring into them.

As cercarial forms were not found when it was possible to carry out the work of feeding encysted forms to sheep and rabbits—that is, when the rush of routine work at the Laboratory was over after the New Year—this experimental portion of the investigation remains to be carried out during the coming season.

One factor which may have a bearing on the question—and McKay also mentions this fact in connection with his work in Australia—is the difference in the pH (*i.e.*, the reaction) of the water of the Hawke's Bay District in question and that of other parts of New Zealand. This Hawke's Bay water is 7·2 or thereabouts, while water at Wallaceville is at least as acid as 6·4; again, just outside the range of fluke-infestation of sheep the pH is 6·8. Neutral water has a pH of 7·0.

Though this fluke-investigation is by no means completed, yet the examination of many water snails has made it possible to record that the intermediate host of the liver-fluke (*F. hepatica*) in New Zealand is the common water snail *Potamopyrgus antipodum* var. *zelandeae*.

The life-cycle of the fluke may be set out as follows :—

Adult fluke present in sheep.
Egg present in fæces.
Miracidium present in swamp-water.
Sporocyst, Redia, Redia, Cercaria } present in snail.
Encysted cercaria present in water-weed eaten by sheep.
Larval fluke present in intestine of sheep.
Larval fluke present in peritoneal cavity of sheep.
Adult fluke present in bile-duct of sheep.

My thanks are due to Mr. H. J. Findlay for his identification of species of water snails.

ASHBURTON EXPERIMENTAL FARM.

OPERATIONS IN 1926–27.

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OPERATIONS at the Ashburton Experimental Farm during the agricultural year 1926–27 were conducted as usual under the working management of Mr. J. G. McKay. The practice in the past, with a few exceptions, has been to publish in one report the results of all experimental work carried out on the farm. The large amount of data becoming available under present methods, however, would render the report too long for publication in any one month. Moreover, there is a decided risk of much of the specific work losing its identity and being disregarded if incorporated with a mass of other material. It has therefore been arranged to publish as separate articles the results of the main experiments examined by the statistical method. These will be contributed to the *Journal* by Mr. A. W. Hudson, who is specializing in this branch of the work in Canterbury. The principal subjects (continuing in most cases the records of the 1925–26 year's work, published in the *Journal* for November last) comprise the following :—

(1) Wheat variety trial, with College Hunter's as control.

(2) Manurial experiment with wheat—Ammo-Phos *versus* superphosphate and sulphate of ammonia.

(3) Manurial experiment with oats, comparing the effect of superphosphate against a proprietary grain-manure in quantities of 1 cwt. and 2 cwt. per acre.

(4) Top-dressing of lucerne ; further increases resulting in 1926–27 from the application of lime and superphosphate in 1924.

(5) Treatment of seed wheat ; the effect of Semesan, copper carbonate, and formalin upon germination and yield. The results of this trial have been so strikingly in favour of Semesan and copper

carbonate, both in germination and subsequent yield, that to publish the results of this one year's trial might be very misleading. A second year's test appears desirable before any results are published, and further trial sowings were made last autumn. These included bluestone in addition to the other treatments specified. It may be noted here that the various treatments so materially affect germination that the varying yields may be due as much to thick and thin seeding as to any direct action of the treatment. The trial this current year has been designed to examine the effect of thick and thin seeding as distinct from that of the treatment.

Green manurial experiment with oats; determination of the effect of ploughing in various crops upon the yield of oats. Owing to the variable nature of the soil on the farm this experiment will be discontinued, and the results obtained during the past season will not be published.

Following are notes on more general work carried out on the farm during the past year:—

PURE LINES OF SEED.

A pure line of Dreadnought wheat, selected by Mr. McKay during 1924, yielded sufficient grain to enable it to be passed for multiplication to Mr. J. Ruddenklau, of Glenavy, South Canterbury. A limited supply of seed should be available for distribution by Mr. Ruddenklau after the season 1927–28. In the meantime further selection is in progress to enable pure seed to be distributed every few years.

Mr. McKay is also engaged in raising pure seed of Major, Marquis, Red Fife, Yeoman, Trifolium 14, and Essex Conqueror wheats, with a view to having such seed available for co-operative field trials during the next few years.

The Ferristen mangold, a variety of Danish origin selected over a series of years at the late Moa Seed-farm, Central Otago, has proved of sufficient promise to warrant further trials. Seed is not available, but from a number of roots grown during the past year it is hoped next season to harvest sufficient to enable a comprehensive trial to be carried out.

POTATOES.

In view of the initiation of seed-potato certification this season a large number of varieties were grown on the farm, the seed having been collected from various sources in Otago, Southland, and Canterbury. The object was to collect data in regard to the characteristics of our commercial varieties and to determine the general standard as to purity and disease. Twenty varieties were under test, and of sixty-two lines submitted seven were wrongly named and the remainder contained 7·8 per cent. of rogues. Counts were also made of plants in each line obviously below the general standard, and these revealed the presence of 26·7 per cent. of subnormal plants, due in most cases to the presence of disease. Opportunity was taken to make a large number of single plant and tuber unit selections from the healthiest lines submitted. It is hoped to make use of these in the production of pure disease-free lines.

LUCERNE.

Satisfactory evidence is again forthcoming as to the value of lucerne for hay and grazing purposes in the district. In the report for the 1925–26 season it was stated that, "although certain areas have been grazed on almost every occasion since they were sown in March, 1921, there is very little evidence of deterioration due to grazing; nevertheless such evidence is directly proportionate to the extent of grazing carried out." It now becomes necessary to add that the past season (1926–27) is the first in which any marked deterioration has been evident as a result of grazing the stands on this farm. An area grazed throughout the 1925–26 season for the first time was fully 8 in. shorter in growth in October than the adjoining area that had been hayed. The season was dry, growth was very scanty after the New Year, and the yields of hay were lower than in any previous year.

The following grazing records, supplied by Mr. McKay, afford ample evidence of the value of lucerne:—

Area of 9 acres:—

146 hoggets and wethers	Sept. 14 – Oct. 18 = 34 days.
150 hoggets and wethers	Oct. 30 – Nov. 17 = 18 days.
74 ewes and 74 lambs	Nov. 8 – Nov. 17 = 10 days.
66 ewes and 74 lambs	Dec. 6 – Dec. 28 = 22 days.

Area of 11 acres:—

Hayed, yielding a little over 1 ton of hay per acre. Grazed 290 dry ewes, Nov. 29 to Dec. 8 = 10 days.

Combined area (20 acres):—

66 ewes and 73 lambs	Dec. 29 – Jan. 31 = 34 days.
89 wethers and 47 lambs	Feb. 20 – Feb. 24 = 5 days.

Area of 13 acres:—

430 hoggets	Sept. 16 – Oct. 5 = 19 days.
150 ewes	Nov. 5 – Nov. 19 = 14 days.
140 ewes	Nov. 9 – Nov. 29 = 20 days.
147 hoggets	Dec. 13 – Jan. 7 = 25 days.
66 ewes and 47 lambs	Feb. 5 – Feb. 9 = 4 days.
89 wethers and 47 lambs	Feb. 10 – Feb. 19 = 9 days.

An area of 2 acres that had been planted in wide rows was cultivated in March, 1926, and sown down with 1 acre each of Garton and Algerian oats at 2 bushels per acre. These were harvested with the main lucerne crop in November. The Algerians were then in ear, though not quite at the milk stage, and the Garton's were still in the shot blade.

The oats had a decidedly depressing effect upon the growth of the lucerne. They also bulked largely in the mixture, and, as they required more weathering, difficulty was experienced in saving the combination of lucerne and oats in good condition.

PLANT-DISEASE CONTROL.

Mr. J. C. Neill, Field Mycologist, has again made full use of the farm in conducting research work upon disease-control. One area was devoted to the control of corticium in potatoes, the seed being subjected to various treatments before planting. A second area was used for comprehensive trials in connection with the control of cereal diseases.

WHITE ISLAND MINERAL DEPOSIT.

TRIAL AS TOP-DRESSING FERTILIZER FOR PASTURE.

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THE attention of farmers and others interested in agriculture has been drawn during recent years to products from White Island, the active volcanic island in the Bay of Plenty. A proprietary company is working various deposits, which are on the market as fertilizers. There is a guano of comparatively low-grade quality, and also a mineral deposit consisting mainly of sulphur, gypsum, and silica. While the value of bird-guano is well known as a fertilizer, the value of White Island mineral deposit, which forms the base of several mixtures now offered, is not so well known. The product being a local one, and many inquiries having been received of late by the Department of Agriculture as to its efficacy as a fertilizer, experiments were commenced last year to test it. The trials were made on grass pasture, and the ground mineral deposit was tried as a top-dressing side by side with superphosphate. The chemical analysis of the sample submitted was as follows :—

	On Sample as received.	On Water-free Sample.
	Per Cent.	Per Cent.
Water	20·8	..
Free sulphur	20·9	26·4
Calcium sulphate (gypsum)	8·9	9·9
Silica	42·5	53·7
Nitrogen	0·02	0·02
Phosphoric acid	Trace	Trace
Potash	Trace	Trace

As there is no appreciable quantity of either phosphate, nitrogen, or potash contained in this substance, it could not be registered as a fertilizer under the Fertilizers Act. By reason of its sulphur and gypsum content, however, it may possess fertilizing-qualities.

Attention has often been directed to sulphur as an element of importance in plant-nutrition, and it has been claimed that the sulphur content of superphosphate is partly responsible for the undisputed success of this fertilizer. But this has never been definitely proved; in fact, applications of pure sulphur to crops in New Zealand have never met with any noticeable success. Gypsum has long been regarded as a soil-improver. Some authorities have stated that, in addition to its other benefits in relation to the soil, it releases potash and makes it available as a plant-food. Its beneficial effect on the physical condition of the soil, in common with burnt lime, was recognized many years ago, when the practice of applying "land plaster," as it was then called, was quite common. The mineral mixture of gypsum and sulphur, &c., it was suggested, might prove of use to crops in one or more ways. It might be a direct plant-food, or it might act as an agent which could release and make plant-food available; or it might be used in conjunction with phosphatic fertilizer, such as rock phosphate, to render the phosphate more

readily available. The Department therefore decided to test this White Island product.

An experiment was laid down in 1926 on the property of Mr. R. Burke, Waihou. The material was used as a pasture top-dressing, and its effects were compared, as stated, with those of superphosphate, while portions of the field were left unmanured. The field had been down in grass for fourteen years, and previous to treatment had been top-dressed for five years—the first year with a mixture of 1 cwt. blood and bone and 2 cwt. super per acre, and the subsequent four years with 2 cwt. to 3 cwt. super annually. It had been cut for hay for five successive years. The soil is a light loam, overlying pumice rubble, typical of much of the Thames Valley and Waikato. The adverse effects of repeated cutting for hay and of hard grazing were demonstrated by the turf carried, which was chiefly composed of cocksfoot, yellow suckling-clover (trefoil), rib-grass, hair-grass, and Yorkshire fog, although a few of the better grasses, &c., including perennial rye-grass, crested dogstail, and white clover, were present. Under such conditions, therefore, the fertilizers had every chance of asserting themselves in improving the pasture.

The manures were applied on 14th July, and the application of both White Island product and super was at the rate of 3 cwt. per acre, although, owing to the damp nature of the former and the varying rate at which it ran through the drill, the quantity actually sown was slightly under the intended amount. Thirteen plots, each ½ chain wide by 8 chains in length, were alternated, giving four plots of each manure and five check plots. The field was closed for hay during early October, and cut on 8th January last. Two cuts of the mower were taken along each plot, and each swath was measured up into chain lengths and the green material on each weighed. The swath nearest to the adjoining plot was taken in each case for making comparisons by "Student's" method, the results being presented in the following table:—

Treatments: A compared with B.	Number of Paired Plots.	Yield of Green Material per Acre.	Difference in Favour of A.	* Difference Significant (S.) or Non-significant (N.S.).
		Tons.	Tons.	
A. Super	21	6·17	0·444	S.
B. No manure		5·73		..
A. No manure	28	5·72	0·437	S.
B. White Island product ..		5·29	..	..
A. Super	21	5·51	0·400	S.
B. White Island product ..		5 11	..	..

* A difference in regarded as "significant" when the chances are greater than 30 to 1 in its favour.

Cost of manures: Super, £5 12s. 6d. per ton f.o.r.; White Island product, £6 10s. per ton f.o.r.

It will be seen that superphosphate gave weight-increases over both check (no manure) and White Island product; while the latter, when directly compared with no manure, caused a depression in yield. The trials will be carried a further stage during the season of 1927-28.

WHEAT-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926–27.

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Co-operative experiments on the manuring of wheat were again carried out in the past season on four farms in the Springs and Ellesmere districts. The methods employed for the sowing, harvesting, and threshing of the crops followed the uniform practice adopted by the Fields Division in Canterbury, which was described in a special article published in the *Journal* for July, 1926.

Experiment 1: Farm of J. Foster, Ladbrook's.

Sowing in this experiment took place on 26th June, 1926, and the plots were harvested on 3rd February, 1927. The wheat variety was College Hunter's, sown at the rate of 1½ bushels per acre. The previous history of the field was: 1925–26, potatoes; 1923–25, grass; 1922–23, wheat. The soil was defined by analysis as a silty loam.

The manurial treatments, at per-acre rate, were as follows:—

(1) Control (no manure).
(2) Super, 42/44 per cent. tricalcic phosphate .. .. 1 cwt.
(3) Super, 42/44 per cent. tricalcic phosphate .. .. 2 cwt.
(4) Basic super, 41/43 per cent. tricalcic phosphate .. .. 1 cwt.
(5) Basic super, 41/43 per cent. tricalcic phosphate .. .. 2 cwt.
(6) Super, 1 cwt., plus dried blood (approx. 13 per cent. nitrogen), 1 cwt. .. .. 2 cwt.
(7) No. 6 mixture, plus sulphate of potash (48 per cent. K_2O), ½ cwt. .. .. 2½ cwt.

Seven replications of the above were sown, and the plots divided into four subplots at harvest. Up to twenty-eight plots were therefore available for comparison. Accidents during threshing, &c., were responsible for loss of correct weights of some plots; hence the number of paired plots in the table varies with different treatments.

Observations during Growth.

24th August, 1926: All manured plots equal in appearance and slightly better than control.

15th November: The crop had an exceptionally good deep-green colour. The controls were about 6 in. shorter than the average of the manured plots (see Fig. 1). The super, 2 cwt., and basic super, 2 cwt., per-acre plots were taller than the other manured plots.

11th January, 1927: Rust was very much in evidence. Apart from a slightly greener tinge, the controls were not distinguishable from the manured plots.

The yield results of this experiment are shown in Table 1. (Note.—The small differences in yield between the same treatments where recorded in more than one place are due to the different numbers from which the respective means have been calculated. This applies to all the tables.)

FIG. 1. WHEAT-MANURING EXPERIMENTAL PLOTS ON J. FOSTER'S FARM, LADBROOK'S.

Mr. J. W. Hadfield standing with one leg in a control plot (showing shorter growth) and the other in a super, blood, and potash plot. A 1-cwt. basic super plot lies on right of control.

[*Photo by the Writer.*

Table 1.—Results of Experiment 1.

[Seven replications of each treatment. Plots divided into four subplots at harvest. Area of individual subplot, $\frac{1}{103{\cdot}7}$ acre.]

Treatments: A compared with B.	Number of Paired Plots.	Bushels per Acre.		*Difference Significant (S.) or Non-significant (N.S.).
		Yield.	Difference.	
A. Control (no manure)	27	41·9	..	..
B. Super, 42/44, 1 cwt.		46·9	5·0†	S.
A. Control	26	41·8	..	..
B. Basic super, 1 cwt.		46·8	5·0	S.
A. Super, 1 cwt.	25	47·6	0·3	N.S.
B. Super, 2 cwt.		47·3	..	..
A. Basic super, 1 cwt.	25	47·1	0·7	N.S.
B. Basic super, 2 cwt.		46·4	..	..
A. Super, 1 cwt.	24	47·8	0·9	N.S.
B. Super, 1 cwt.; dried blood, 1 cwt. ..		46·9	..	..
A. Super, 1 cwt.; dried blood, 1 cwt. ..	24	46·4	..	..
B. Super, 1 cwt.; dried blood, 1 cwt.; sulphate of potash, ½ cwt.		47·9	1·5	S.

* A difference is regarded as "significant" when the chances are greater than 30 to 1 in its favour.
† The difference in each case is shown opposite the higher-yielding plot.

Comments.

(1) Super, 1 cwt., and basic super, 1 cwt., show equal increases over the control. Five bushels at 5s. per bushel (approximate net value after allowing for threshing, hauling, railage, &c.) must be regarded as a highly profitable increase, the manure costing only about 6s. per cwt.

(2) Neither form of phosphate at 2 cwt. per acre has shown any increase over the same phosphate at 1 cwt. Hence the growth noted on 15th November did not indicate the result.

(3) The addition of 1 cwt. dried blood to 1 cwt. super has not caused an increase over the straight-out 1 cwt. super. This is not surprising, as none of the plots showed any indication of lack of nitrogen so far as can be measured by growth and colour of the crop.

(4) Sulphate of potash ($\frac{1}{2}$ cwt.) added to super and blood has been responsible for a definite increase of $1\frac{1}{5}$ bushels per acre over the super and blood. This increase, however, is not a paying one; cost of the potash is 9s. for $\frac{1}{2}$ cwt., and value of increase due to it 7s. 6d.

(5) A direct comparison between 2 cwt. quantities of super and basic super shows no significant difference.

(6) Like many of the wheat crops grown on the better-class land in the past season, the one under review suffered severely from rust-attack, and did not yield up to expectations.

Experiment 2: Farm of Messrs. W. and A. Campion, Prebbleton.

Date sown, 12th June, 1926; date harvested, 1st February, 1927; variety, Solid-straw Tuscan; seeding, $2\frac{1}{4}$ bushels per acre. Previous history of field—1925 26, Italian rye-grass; 1925, crop of rape ploughed in; 1923-24, wheat, and fallowed from time wheat crop taken off till rape was sown. The soil is a medium loam, somewhat lighter than that of Foster's farm.

The manurial treatments used were the same as for Experiment 1. Eight replications were put down, each plot being divided into three subplots at harvest-time.

Observations during Growth.

On 24th August the controls were very backward (see Fig. 2). Throughout the growing-period the manured plots showed a marked superiority of growth over the controls, although the latter were of a decidedly better colour. Of the manured plots super and blood, super and blood and potash, and super, 2 cwt., were the best grown. The whole of the manured plots appeared to have outgrown the nitrogen-supply, and exhibited signs of nitrogen starvation. This was most marked on the heavily phosphated plots, and least evident on the plots having blood.

The yield results are shown in Table 2.

Comments.

(1) The increases over control of 2·7 and 3·4 bushels per acre from super, 1 cwt., and basic super, 1 cwt., respectively are quite profitable.

FIG. 2. VIEW OF PLOTS ON FARM OF W. AND A. CAMPION.

Where possible, experiments are laid down alongside a road, and a notice drawing attention to the experiment is erected. A box below the notice contains typewritten descriptions of the experiments, which in conjunction with the pegs enable interested farmers to watch the effect of the different manures.

[*Photo by E. M. Bates.*

Table 2.—Results of Experiment 2.

[Eight replications of each treatment. Plots divided into three subplots at harvest. Area of individual subplot, $\frac{1}{95{\cdot}25}$ acre.]

Treatments: A compared with B.	Number of Paired Plots.	Bushels per Acre.		Difference Significant (S.) or Non-significant (N.S.).
		Yield.	Difference.	
A. Control (no manure)	24	25·9	..	
B. Super, 42/44, 1 cwt.		28·6	2·7	S.
A. Control	24	25·9	..	..
B. Basic super, 1 cwt.		29·3	3·4	S.
A. Super, 1 cwt.	23	28·8	..	..
B. Super, 2 cwt.		30·1	1·3	N.S.
A. Basic super, 1 cwt.	23	29·4	0·2	N.S.
B. Basic super, 2 cwt.		29·2	..	..
A. Super, 1 cwt.	24	28·6	..	
B. Super, 1 cwt.; dried blood, 1 cwt. ..		32·1	3·5	S.
A. Super, 1 cwt.; dried blood, 1 cwt. ..	24	32·1	..	..
B. Super, 1 cwt.; dried blood, 1 cwt.; sulphate of potash, ½ cwt.		32·6	0·5	N.S.

A direct comparison between the yields from these two manures shows no significant difference.

(2) Super 2 cwt. does not give a significant increase over 1 cwt. of the same manure. The chances in this case approach significance. In any case, the increase of 1·3 bushels is worth only 6s. 6d., so that even if the difference is real it does little more than pay for 1 cwt. of super.

(3) The 1-cwt. and 2-cwt. basic super plots do not differ appreciably.

(4) A direct comparison of 2 cwt. super with 2 cwt. basic super shows that the plots of these two manures do not differ significantly in the yield.

(5) Blood added to super has registered an increase over the straight phosphate of 3·5 bushels per acre. Value of increase at 5s. per bushel equals 17s. 6d.; cost of 1 cwt. dried blood, 13s.; profit, 4s. 6d. per acre over that obtained from super. It is highly probable that an equivalent amount of nitrogen in the form of nitrate of soda or sulphate of ammonia would have been of considerably greater benefit.

(6) ½ cwt. of sulphate of potash added to the super and blood has been of no benefit.

Experiment 3: Farm of F. W. Carpenter, Ladbrook's.

Date sown, 26th May, 1926; date harvested, 25th January, 1927; variety, Solid-straw Tuscan; seeding, 1¼ bushels per acre. Previous history of field—1925–26, rape; 1924–25, Italian rye-grass; 1923–24, rape. The soil is similar to that on Campions' farm.

The manurial treatments given per acre were as follows:—

Control (no manure).
Super, 42/44 per cent. tricalcic phosphate, 1 cwt.
Super, 42/44 per cent. tricalcic phosphate, 2 cwt.
Super, 1 cwt., and nitrate of soda, 36 lb.
Super, 1 cwt., and nitrate of soda, 87 lb.
Super, 2 cwt., and nitrate of soda, 87 lb.

The nitrate of soda (containing between 15 and 16 per cent. nitrogen) was applied on 8th September. It had been intended to apply the nitrate of soda at 1 cwt. and ½ cwt. per acre instead of at the rates shown—87 lb. and 36 lb. The physical conditions of nitrate of soda make its uniform application somewhat difficult, however, and the result in this case was that less than the desired amount went on. Ten replications were sown, each plot being divided into three subplots at harvest.

Observations during Growth.

26th August: The manured plots, as seen in Fig. 3, were very superior in growth to the controls, but equal to one another.

27th September: About three weeks after application of nitrate of soda there was no apparent effect from this manure, although at this time the 2-cwt. super plots were decidedly better than those receiving 1 cwt. The whole crop looked quite healthy, and in this case did not exhibit nitrogen starvation to any extent. Ten days later the effect of the nitrogen was much in evidence; the plots receiving nitrate of soda displayed an increased growth, and had taken on a very deep-green colour.

FIG. 3. PLOTS ON F. W. CARPENTER'S FARM.

At this stage the plots afforded a striking example of the effect of superphosphate on early growth. The backward plots are the controls.

[*Photo by E. M. Bates.*

From early October to the time of ripening the superiority of the nitrogen-treated plots was very marked. The plots having phosphate alone never looked as healthy as the control or nitrate plots, although their growth was greater than that of the controls.

The yield results are shown in the next table.

Table 3.—Results of Experiment 3.

Ten replications of treatments. Plots divided into three subplots at harvest. Area of individual subplot, $\frac{1}{84.9}$ acre. Number of paired plots, 30.]

Treatment.	Bushels per Acre.		Net Profit per Acre.†
	Yield.	Increase over Control.*	
			£ s. d.
Control	27·9	..	..
Super, 1 cwt.	30·6	2·7	0 7 6
Super, 2 cwt.	30·7	2·8	0 2 0
Super, 1 cwt., and nitrate of soda, 36 lb. ..	33·8	5·9	0 18 6
Super, 1 cwt., and nitrate of soda, 87 lb. ..	35·8	7·9	1 1 0
Super, 2 cwt., and nitrate of soda, 87 lb. ..	36·9	9·0	1 0 6

* The increases over control only are shown in this table. Comparisons indicated in the accompanying comments have been examined statistically.

† Net profit is calculated on the following prices: Super, 6s. per cwt.; nitrate of soda, 16s. per cwt.; wheat, 5s. per bushel. The amount shown represents the difference between the value of the increase and the cost of the manure.

Comments.

(1) The figures in the column headed "Net Profit per Acre" (Table 3) show quite clearly the position of the treatments.

(2) Failure of the 2 cwt. super, which promised well during growth, to give an increase over the 1 cwt. has reduced the net profit to a very small amount. Hence 1 cwt. has been a better-paying application.

(3) Of the plots treated with nitrate of soda, the 1-cwt. super plot receiving 87 lb. nitrate of soda shows the best returns.

(4) It is interesting to note that even the small application of 36 lb. nitrate of soda to 1-cwt. super plots has given an increase over 1 cwt. of super amounting to 3·2 bushels per acre.

(5) A direct comparison of super, 1 cwt., plus nitrate of soda, 87 lb., and super, 2 cwt., plus nitrate of soda, 87 lb., shows a significant increase in favour of the latter to the extent of 1·1 bushels per acre. In view of the fact that 2 cwt. super failed to increase the yield over that of 1 cwt., the result indicates that full use could not be made of the heavier dressing of phosphate so long as some other factor (in this case nitrogen deficiency) was operating.

(6) The increases resulting from the application of nitrate of soda are very similar to those obtained in the preceding year on the same farm, when 93 lb. nitrate of soda top-dressed on a 1-cwt.-per-acre super plot caused an increase of 5·9 bushels per acre over the straight-out 1 cwt. super (see *Journal* for August, 1926, page 112). This point is important, as the winter of 1925 was one of the wettest on record, and must have caused excessive leaching of nitrates, while that of 1926 was an equally dry one, although the late spring brought plentiful rain.

(To be continued.)

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1926-27.

Dairy Division.

LISTS of butter and cheese factories that have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1926, to 31st July, 1927—are here presented. Last year's lists included all factories with an average grade of 92 points and over, but it has now been decided to limit publication to averages of 93 points and upwards. It is very satisfactory to note the improvement in quality of both butter and cheese during the past year. The number of factories averaging 93 points and over shows an increase of thirty-one in butter and forty-eight in cheese manufacture as compared with the 1926 lists.

BUTTER-FACTORIES.

Name of Company.	Registered No.	Brand.	Average Grade.
Rangitikei	1360	Rangitikei ..	95·030
Wairoa	1345	Wairoa	94·944
Heretaunga	1230	Heretaunga ..	94·775
Awahuri	664	Red Rose	94·738
Taieri and Peninsula (Dunedin) ..	54	Taieri and Peninsula	94·620
Levin	910	Lake	94·606
Mangorei	345	Mangorei	94·553
Waitaki	812	Waitaki	94·500

BUTTER-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
Cheltenham	3	Pakeha	94·352
Waitara	726	Waitara	94·332
Wangaehu	1326	Wangaehu	94·289
Midhirst	110	Rugby	94·272
Lepperton	49	Lepperton	94·270
Uruti	300	Uruti	94·235
Moa Farmers'	341	Inglewood	94·188
Bell Block	488	Bell Block	94·166
Rata	938	Rata	94·073
Waipukurau	1455	Mount Vernon	94·072
Kia Ora	926	Kia Ora	94·059
Tolaga Bay	1007	Tolaga Bay	94·036
Masterton	1307	Masterton	94·010
Tarata	631	Tarata	93·986
Tarurutangi	728	Champion	93·975
Stratford	68	Stratford	93·949
Taihape	1188	Tikapu	93·837
Maketawa	342	M.D.C.	93·829
Shannon	1489	Shannon	93·824
Tariki	1818	Tariki	93·799
Tikorangi	102	Shield	93·725
North Taranaki	723	Flax	93·712
New Zealand (Ngatea)	291	Anchor, &c.	93·702
Mauriceville	14	Mauriceville	93·675
Farmers' Dairy Federation	336	Murihiku	93·625
Palm	1838	Palmerston	93·582
Taieri and Peninsula (Oamaru)	1234	Taieri and Peninsula	93·540
Norsewood	600	Norsewood	93·528
New Zealand (Frankton Junction)	1510	Anchor, &c.	93·527
Omata	82	Omata	93·513
Piopio	603	Piopio	93·462
Co-operative of Otago	266	Huia	93·460
Kairanga	1768	Longburn	93·421
Kaikoura	302	Kai	93·370
Ngatiporou	395	Nati	93·323
Kiwi	299	Kiwi	93·314
Raetihi	717	Raetihi	93·306
Rongotea	8	Rongotea	93·303
New Zealand (Waiuku)	111	Anchor, &c.	93·253
Owaka	328	Owaka	93·250
New Zealand (Waharoa)	293	Anchor, &c.	93·239
Ormondville	735	Ormondville	93·217
Kaitieke	1119	Kaitieke	93·210
Konini	1203	Konini	93·206
Eltham	31	Eltham	93·179
Golden Bay	146	Golden Bay	93·161
West Coast Farmers'	675	Silver Pine	93·150
Te Aroha	344	Overseas, &c.	93·128
Waikato Valley	397	Waikato Valley	93·093
Golden Coast	991	Golden Coast, &c.	93·070
Opotiki	337	Opotiki	93·039
Lowgarth	629	Lowgarth	93·033
Waimate	244	Waimate	93·030
Rangiwahia	750	Quail	93·025
Tai Tapu	175	Tai Tapu	93·025
Okoia	413	Okoia	93·020
Manutahi	495	Manutahi	93·019
Ruawai	66	Ruawai	93·017

CHEESE-FACTORIES.

Name of Company.	Registered No.	Brand.	Average Grade.
Milton	1030	Milton	94·130
Omimi	74	Omimi	94·060
Waiohiki	1681	Waiohiki	93·924
Bell Block	488	Bell Block	93·924
Edendale	36	Pioneer	93·776
Bidwell	270	Bidwell	93·748
Kaiparoro	619	Bruce	93·723
Cardiff	10	C.C.C.	93·717
Staveley	1719	Staveley	93·690
Kairanga	184	Fitzherbert	93·689
Takamatua	33	Takamatua	93·684
Tamaki	1463	Tamaki	93·622
Lowgarth	629	Lowgarth	93·597
Dalefield	9	Dalefield	93·577
Pembroke	234	Pembroke	93·563
Pihama	627	Pihama	93·555
Kairanga	182	Kairanga	93·547
Ngaere	25	Triumph	93·509
Westmere	1621	Westmere	93·506
Hopelands	1178	Hopelands	93·495
Temuka	207	Ohape	93·438
Ryal Bush	477	Ryal Bush	93·437
Brown's	925	Brown's	93·433
Tuturau	132	Tuturau	93·427
Seaward Downs	702	Seaward Downs	93·423
Tamaki	58	Tamaki	93·406
Collingwood	1742	Collingwood	93·400
Mosgiel	161	Mosgiel	93·400
Kahui	493	Kahui	93·397
Boggy Burn	703	Boggy Burn	93·380
Kaponga	1696	Rowan	93·368
Milford	267	Milford	93·365
Little Akaloa	32	Little Akaloa	93·360
Ashburton	81	Ashburton	93·360
Kaupokonui	1733	Kaupokonui	93·352
Uruti	300	Uruti	93·351
Collingwood	1254	Collingwood	93·345
Alton	1890	Alton	93·301
Fairfax	1004	Fairfax	93·299
Kairanga	1768	Longburn	93·281
Mangatoki	136	Mangatoki	93·244
Kaupokonui	633	Kaupokonui	93·243
Waitoitoi	20	Waitoitoi	93·242
Silverstream	264	Silverstream	93·240
Mangatoki	1086	Mangatoki	93·231
Paretai	271	Paretai	93·230
Oware	662	Oware	93·175
Carrington	621	Carrington	93·163
Woodville	1892	Woodville	93·158
Woodlands	1485	Woodlands	93·145
Awarua	545	Awarua	93·144
Momona	1010	Momona	93·140
Waimana	1817	Waimana	93·138
Nireaha	335	Nireaha	93·135
Kaimata	992	The Oaks, &c.	93·131
Wyndham	59	Wyndham	93·128
Kuku	905	Ohau	93·118
Waiotahi	1159	Waiotahi	93·117
Kakaramea	630	Kakaramea	93·103
Stirling	292	Stirling	93·080

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
Waikouaiti	18	Waikouaiti ..	93·080
Wellington Dairy-farmers' ..	252	Onward	93·079
Belvedere	486	Belvedere	93·076
Barry's Bay	401	Barry's Bay ..	93·070
Taratahi	101	Taratahi	93·044
Bell Block	71	Dove	93·024
North Tiraumea	1559	North Tiraumea ..	93·018
T. L. Joll	1723	Joll's	93·000

THE FIREBLIGHT REGULATIONS AND HAWTHORN.

SHORTLY after the outbreak of fireblight in New Zealand it became evident that the hawthorn was an important host plant for the disease; further, that owing to the fact of it being planted in hedge form it was playing and would continue to play a most important part in the spread of the disease. Experience soon demonstrated that fruitgrowing on a commercial basis could not be carried on satisfactorily side by side with such hawthorn hedges once fireblight had made its appearance.

In order to meet the position, and to give fruitgrowers an opportunity of combating the disease with some chance of success, and at the same time take into account the farmers' interests in the matter of hawthorn hedges, it was decided to declare specific commercial fruitgrowing districts throughout the Dominion. The Fireblight Act, 1922, and regulations thereunder provide for this. The regulations gazetted on 19th May last comprise three schedules; each schedule provides for a different class of treatment with respect to hawthorn existing in the areas defined therein, and portions of any declared fruitgrowing district may appear in each schedule. As the uninitiated may find some difficulty in understanding the regulations set out in their legal form, the following brief explanation is offered:—

First Schedule: All declared fruitgrowing districts appear in the First Schedule of the regulations, together with details of the boundaries of each. No special treatment of hawthorn existing in areas which appear only in this schedule is called for.

Second Schedule: Should fireblight at any time spread in such a manner as to suggest the possibility of its early entry into any specific fruitgrowing district, steps may be taken, as a precautionary measure, to have all hawthorn hedges, &c., cut back in such a manner as to prevent flowering. When such a step is decided upon the whole or any specified portion of such district is first transferred from the First to the Second Schedule of the regulations. All hawthorn growing on property coming within this schedule must be cut back so as to prevent any portion of the hawthorn from flowering.

Third Schedule: Should fireblight actually make its appearance in a declared fruitgrowing district, the whole or any portion of such area may be transferred from the First or Second to the Third Schedule. In this event the regulations provide that all hawthorn existing on property coming within the Third Schedule shall be destroyed.

In given circumstances it is quite possible for portions of a declared fruitgrowing district to appear in each of the three schedules. When portions of a district are transferred to the Second and Third Schedules in the manner indicated, definite boundaries of the portions affected are set out. Hawthorn existing outside the several officially declared fruitgrowing districts is unaffected by the regulations.

—*Horticulture Division.*

SEASONAL NOTES.

THE FARM.

HAYMAKING MACHINERY.

MACHINERY for harvesting the hay crop should normally be put in repair immediately after haymaking is finished, but in cases where this was not done all the implements should be overhauled and put in order during the coming month. The grass-mower should be first attended to, as it will be required in November for cutting ensilage material and early hay crops, and mowing rank pasture-grass.

The Mower.—Many grass-mowers on farms are badly neglected, and after a few years' work cut very badly. Some people are under the impression that the knife does all the cutting, and confine their attention to grinding it. The knife section, however, is only one blade of the shears that cut the grass; the other blade is the ledger-plate of the finger-bar, and for efficient cutting both edges must be sharp and in close contact.

After a time the edges of the ledger-plates become dull and worn. Before putting a mower away the plates should be greased to prevent them from rusting. If the plates are badly worn they should be renewed. Some mowers are provided with fingers having detachable plates; in other machines, where the plate is welded in, a new finger is required when the plate becomes worn. The best sharpener for the knife sections is a grindstone, using plenty of water to keep the knife cool. Sections that are worn or ground until they are short from the point to the base will not cut clean, and the worn sections should be renewed.

Lack of contact between the knife section and the ledger-plates is a common source of bad cutting, and is usually due to some of the plates being worn and new plates on some of the fingers raising the knife off the worn ones. When putting on new fingers thin washers are often required to bring them into alignment with the old ones. The knife is kept from lifting by means of caps; these caps, however, should not be in contact with the knife, but just allow it free movement.

When the knife is at the end of its outwards or inwards stroke the knife section should lie in the centre of the fingers; if the sections do not centre, the cut is ragged and the draught is increased. This defect is usually due to the pitman not being of the correct length. Most metal pitmans allow of adjustment. Another cause of this defect is that the bar is out of alignment, which may have been caused by bending after striking some object or from continuously cutting round corners. Besides causing bad cutting, a disaligned bar causes severe wear on the knife-head.

Sweeps and Elevators.—The number of haystacks which caught fire last season in parts of the North Island makes one wonder whether the methods commonly used in stacking are altogether suitable for modern small dairy farms. It is not that the horse-sweeps and elevators are unsuitable for haymaking—this is far from being the case. It is the common ownership of the outfit, necessitating that each man's hay

be stacked by a certain time, that is at the root of the trouble. In a wet season, such as that of last year, the hay is rushed in before it is dry and large stacks are built; they are consequently liable to take fire. It would certainly pay to partially cure the hay in cocks in seasons when the weather is unfavourable. Cured in cocks, the hay retains its colour and is more palatable than when bleached by the sun.

Horse-sweeps and elevators are only suitable for haymaking on a large scale, and their use on a small dairy farm is one of the great bars to closer subdivision. It is the main cause for there usually being three 10-acre or 12-acre fields on most 50-acre and 60-acre dairy farms. These comparatively large fields allow of all the hay for the season being cut from one field, and also of the fields being alternately hayed and grazed. It is a matter for the individual farmer to decide whether the extra labour at haymaking in cocking and carting the hay is not more than balanced by the extra feed obtained by closer subdivision. If horse-sweeps and elevators are retained—and there is no reason why they should not be, provided care is exercised to stack the hay in good condition—closer subdivision could be quite well carried out were movable panels provided in the fences to allow the sweeps to pass from one field to another.

ARABLE CROPS.

Mangolds.—The more general cultivation of mangolds on dairy farms would enable many herds to be wintered more satisfactorily than they are at present. The secret of success in quickly bringing cows to their maximum production lies in fairly heavy winter feeding on hay and roots, so as to allow early top-dressed grassland to be spelled during the winter months, and utilizing this protein-rich young grass in the early spring, after the cows have calved. Excessive hay feeding in the winter is often the cause of digestive troubles in cows, and the supplementary fodder should consist of both hay and roots. Mangolds, on account of their heavy yield and comparative freedom from disease, are excellent for feeding in the winter and early spring.

On small dairy farms in the wetter parts of the North Island mangolds can be grown quite successfully without any great outlay for implements. Quite a common method is to sow the seed in beds in September and plant out into the field in October–November when the bulbs are about the size of a man's thumb. The land is ploughed early, worked down, and then reploughed when planting is done, the plants being placed on the edge of the furrows as the land is ploughed. This method is quite satisfactory as long as the plants are set out before the weather is likely to be hot and dry. When grown on a fairly large scale the use of the ridger is desirable.

Among good varieties are Prizewinner Yellow Globe, Giant Orange Globe, White Knight, White Sugar, Jersey Queen, and Red Intermediate. White Sugar germinates quickly, and this is a great advantage where weeds are troublesome. Sow at the rate of 5 lb. to 6 lb. of seed per acre, with 4 cwt. to 6 cwt. of phosphate fertilizer. Frequently 3 cwt. of salt or kainit is broadcast and worked in a week before sowing.

Linseed.—Linseed should normally be sown about the middle of October. The usual seeding is about 35 lb. per acre, but lighter seeding

—25 lb. to 30 lb.—appears to have given good results. The coulters should be set as shallow as possible and the land rolled after drilling.

Potatoes.—The main crop of potatoes should be got in during October. Potatoes do best on a well-aerated seed-bed, and the final ploughing of the land should be about a month before planting. The ground should be left in a rough state, and then broken down with a heavy grubber and levelled with the harrows just before planting.

Rape and Turnips.—Early sowings of rape, kale, and soft turnips may be made during October and November, but the main sowings will not be made till November, and the chief work to be performed in October is the working-down of the land for these and other late-sown crops such as swedes and lucerne. The nature of the preparatory cultivation for these crops depends on the class of land, the climate, and the position the crops take in a given paddock rotation. In the drier districts preparatory cultivation must be of such a nature as to secure adequate supplies of moisture in the soil for the crop. Generally summer rains do not provide nearly enough moisture for the production of a good crop, and the plants must draw upon the reserves and supplies held in the soil and subsoil. In dry districts, therefore, it is important to plough or stir the land intended for roots in the early winter, so that the rain may readily enter the ground. If the land is ploughed and left in unbroken furrow slices over the winter the rain runs quickly through the top soil and enters the subsoil, and there is little loss by evaporation. Further, this early cultivation, by its exposure of the soil to weathering influences, will lessen the amount of spring cultivation necessary, and thus reduce the amount of moisture lost during the spring cultivation.

—P. W. Smallfield, Instructor in Agriculture, Ruakura.

THE ORCHARD.

SPRAYING.

At least two sprays should have been applied on apple-trees up to the open-cluster period, as referred to in last month's notes. Many growers, in fact, now try to get three sprayings of lime-sulphur on before this stage, the idea being to keep the trees and foliage well covered with a film of spray in order to prevent the germination of any spores of fungus diseases, also to cope with the insect pests that may become active as the warmer spring weather advances. These first sprays are a distinct advantage in the control of red mite, a pest that is becoming a very serious one in many orchards. The elimination of the eggs of red mite, which at this season of the year will be nearing the hatching stage, will do much to prevent a recurrence at a later period when the fruit is reaching maturity and when growers are specially busy making preparations for the harvesting of the crop.

The next stage in the development of blossom-buds is known as the "pink"—undoubtedly an important period and one that should not be missed as far as spraying is concerned. From this stage onward a good many of the orchardist's troubles commence, and consequently thoroughness and efficiency should be the first consideration. It is fully realized

that all varieties of apples do not reach the same stage of development at the same time; therefore it is more difficult for the orchardist to arrange a set spraying programme. But every effort should be made to apply the spray at the right stage if success is to be attained. As an example, when Cox's Orange and Sturmer are at the open-cluster period Delicious is only at tight-cluster and Worcester Pearmain will be barely beyond the green-tip stage. It often means that when spraying at the pink stage there will be continual dodging backwards and forwards throughout the orchard, instead of a straight run through; but better this than neglect to spray any variety at the right stage of development. Lime-sulphur applied at the pink stage at strength 1–60 will be beneficial. Personally, I like two sprayings during the pink period, the first at strength 1–60 just as the pink is showing, and again, in about a week's time, at the advanced pink stage, using strength 1–80. Care should be taken not to spray the trees when in full bloom. Many growers have done this in the past with no apparent ill effects. On the other hand, reports received in other cases have indicated that damage has been done.

Fruit-trees should be kept as dry as possible during the blossoming-period, so that bees and insects, attracted by the bright colours and faint aroma, can function properly. Many of our varieties are self-sterile or only partially fertile, requiring cross-pollination to ensure the setting of a good crop. It is a well-known fact that wet weather during blossoming often results in a poor set; how much more so if the blossoms are covered with a spray that is obnoxious to these friends of the grower —the bees! A good spray, thoroughly applied at the advanced pink period, will carry over until the next stage of development—that is the petal-fall or calyx stage, full notes on which will appear in next month's *Journal*.

Pears will be more advanced than apples, their stage of development being earlier. As soon as the fruit is set it is advisable to spray with bordeaux, 3–4–50, on varieties that are subject to black-spot, taking care to do the work thoroughly, as this is about the time when black-spot usually appears. The less susceptible varieties can be given an application of lime-sulphur at strength 1–80 to 1–100. The addition of arsenate of lead—1½ lb. powder or 3 lb. paste per 100 gallons—at this period should keep any attacks of codlin-moth well in check.

Stone-fruits also will have their fruit well formed by this time, and spraying must be continued as a preventive against brown-rot, leaf-curl, &c. Lime-sulphur, 1–120, has been proved very successful. The addition of 3 lb. to 4 lb. of atomic sulphur will help considerably, and a spreader is recommended from this stage onwards. Should green or black aphis put in an appearance and not be controlled by the lime-sulphur spray, the addition of Black Leaf 40 will ensure success.

CULTIVATION AND MANURING.

The season is advancing, and the application of fertilizer—if not already attended to—should be completed, especially with quick-acting phosphate, as this class of manure is needed as soon as the trees break into growth. Any weak-growing trees in the orchard should be specially attended to, a little extra manure often resulting in restoring vigour.

From 2 lb. to 4 lb. of phosphate per tree, according to condition, should suffice. This should be well spread, not directly round the trunk of the tree, but over the whole rooting-area.

The cultivation of the soil during the spring is most necessary, and should be attended to as soon as the weather permits. Not only will a good tilth be produced, but the soil will be aerated and moisture conserved in the subsoil for the drier periods which follow during the summer. If neglected until later in the season many soils set hard, making it very difficult for any implement to break through the surface. Poor cultivation often means trees making little or no growth, and loss of fruit and foliage.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

Pruning: When danger from frost is over, the tops of trees which have been damaged may be cut back to good, sound growth. At this season it is well to remove all excess growth which has been made on the inside of the trees, also any wood which has been injured by excessive rubbing or disease. All the largest cuts should be made clean, and coated over with coal-tar. While pruning, an inspection should be made for borer infection. The smaller infected twigs should be cut out, but with larger limbs and the trunk benzine should be injected into the burrow and the outlet blocked with soap or putty.

Cultivation: Spring cultivation should be carried out to a depth of at least 6 in. right under the trees, and as deep as possible between the rows. This will assist in forcing the rootlets to a greater depth, and ensure a more equable moisture in the soil during summer.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CARE OF BROODER CHICKS.

STRICT attention to details is the great determining factor in successful poultry-keeping, and there is no matter of greater importance than avoiding late-hatched stock on the plant. This being so, every effort should be made to get the last of the eggs for the season under incubation as early as possible.

In recent notes some advice was given regarding the common causes of mortality in chicks during the brooder stage, but it is as well to again emphasize the necessity of their not being subjected to extremes of temperature. Usually, the later in the season the chicks are hatched the greater is the loss from this cause. It is common for poultry-keepers to work their brooders in exactly the same manner in October and November as during the early season, when heavy frosts are often experienced. This is a mistake. During the early season the weather conditions are more uniform than is the case later, and because of this uniformity the desired degree of temperature and ventilation demanded by the chicks in the brooder can be easily controlled. With the

approach of summer, however, extreme variations of climatic conditions are often experienced, and it is these that must be guarded against.

It frequently happens that a warm night follows a cold one, and that is where the chief danger lies. This is chiefly because the chicks become overheated at night, and in leaving the brooder next morning the extreme change of temperature proves too much for them, resulting in chill and its consequent troubles—white diarrhœa, droopy wings, &c. It will thus be seen that as the season advances the greater must be the attention to ensure that the young birds are provided with a uniform degree of warmth and the necessary fresh air for their welfare.

DRYING DOWN AFTER INCUBATION.

In the artificial hatching of chicks it is generally accepted that the young birds should not be moved from the incubator to the brooder for at least twenty-four hours after being hatched. This is because if the chicks are transferred before they are thoroughly dried off they are highly susceptible to chill. While some poultry-keepers adhere closely to this rule, they make the mistake of not drawing away the water in the moisture-pan which is supplied with most incubators. Very often added moisture, especially during dry weather, is an essential to assist the hatching process, but it is of no use whatever after it has served this purpose. As soon as the hatch is cleaned up all moisture should be withdrawn, as obviously the chicks will not thoroughly dry down if compelled to remain in a humid atmosphere.

As a further means of assisting the drying-down process the ventilators should be opened wide, while it is also a good plan to open the incubator-door about $\frac{1}{8}$ in. for an hour or so before the chicks are removed to the brooder. Of course, special care should be taken to arrange the door in such a way that it will not fall downwards, or serious trouble may result.

ACTION AGAINST VERMIN.

Now that the warm weather is approaching, vermin are apt to multiply in abundance. Even if one is certain that there is no vermin in the poultry-house it is always wise as a preventive to adopt the same necessary measures as if they were present. This means that the perches must frequently be given an application of pure kerosene or strong disinfectant. The nesting-material should be renewed as often as possible, and, above all, the quarters should be maintained in a thorough sanitary state. Dust baths, which are the natural remedy, should be provided to enable the birds to rid themselves of body-lice. No flock can produce the maximum number of eggs if the houses are infested with vermin—particularly that great enemy of the fowl, the red mite.

WOMEN AND POULTRY-KEEPING.

An important movement is being set on foot by certain women's organizations in the North Island for taking advantage of the assistance given by the Department of Agriculture to foster the poultry industry. The aim of these organizations is to arrange meetings in the various districts whereby any women interested in poultry-keeping

may be afforded an opportunity of attending lectures and demonstrations by the Poultry Instructors. No doubt the spread of the movement throughout the country districts would not only do much towards creating interest in poultry matters, but also prove of great educational value to those concerned, and in due course tend to increase the poultry products of the Dominion.

It is very satisfactory to know that farm womenfolk are among those responsible for instituting the organizations referred to, and are taking full advantage of the opportunity afforded of gaining knowledge in connection with the various branches of poultry-management. The interest created in the districts where lectures and demonstrations have already been given is indicated by the fact that requests for our poultry publications are frequent, while inquiries for the Department's utility stock and eggs for breeding purposes are constantly on the increase.

LARGE-SCALE AND SIDE-LINE POULTRY-KEEPING.

Some people are advocating that poultry-keeping should be recommended as a sole means of livelihood and not as a side-line. This contention would be all right in its way if the question of managing a large flock profitably were as simple as it is now difficult. The knowledge of how to make poultry profitable on a large scale is certainly available, but it is essential that such knowledge should first be tested out in practice. Obviously it would not be advisable for the average person to do this at the outset on a large scale. Gaining experience in a small way as a side-line, and extending the plant as warranted by the increased knowledge gained, is the only safe course.

As regards large plants, it is satisfactory to know that these are on the increase throughout the Dominion, as shown by the latest census returns. These go to show that in 1921 there were ninety-six persons keeping flocks of from 500 to 999 birds, while in 1926 the number of such owners had increased to 148. In 1921 there were forty-one plants carrying 1,000 birds and over, while the number in 1926 stood at sixty-six.

It is safe to say that the great majority of those conducting these large poultry plants find the business a profitable undertaking. With the necessary aptitude and knowledge concerning control and management they are enabled to work even to the extent of increasing their present stock on assured lines. Because these men possess the essential qualifications for the successful management of a plant it should not be thought that any one possessing a mere insight of the business can do likewise. For people with no knowledge of the industry to take up the business as a sole means of livelihood would be nothing short of courting disaster. The increasing number of large plants which have been established has been brought about in a natural way, and generally by the type of man well fitted for the business. For the welfare of the industry it will be well to allow the expansion of future large plants to develop along similar sound lines as hitherto. If those who are at present successfully conducting large plants could be induced and encouraged in every way to increase their flocks it would undoubtedly be a means of increasing production and consequently placing the export trade in eggs on a sound footing.

Hitherto the great bulk of the eggs and table poultry has been produced as a side-line by the small settler on the land and the suburban resident, and it will continue to be so, because on such places poultry products can be produced at the lowest cost. The best proof of the increasing popularity of side-line poultry-keeping is the fact that according to the last census the number of householders keeping poultry in the Dominion had increased by 11,102 between 1921 and 1926.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SEASONAL PREPARATIONS.

OCTOBER is perhaps the month when the apiarist can do most to help his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the southern districts they will probably not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. On the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can settle the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost suicidal for the beekeeper to treat his bees in October; in others, where right conditions prevail, it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal

feeding. For full details see Bulletin No. 119, "American Foul-brood and its Treatment." This is issued free, and can be obtained from any of the Department's offices.

HIVING SWARMS.

In most text-books on beekeeping this kind of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. Such advice is all right where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box, with the brush used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are very largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

WATER-SUPPLY.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE TOMATO CROPS.

THE success of the indoor tomato crop depends very largely on the skill and attention given now. The main object at present is to keep the plants growing steadily, and take care that they receive no check. These plants are sometimes checked in growth at this period by deep cultivation interfering with their roots; by the ventilators being left open too wide during a cold snap; or by applying water at too low a temperature. It is just now that the plants require very careful nursing and regular attention to tying and suckering. When the warmer weather arrives and outdoor conditions are suitable the necessary supervision is much reduced, but meanwhile the quantity and quality of the early crop depend on the attention given at present.

In the warmer districts the outdoor tomato crop is planted out towards the end of October, but nothing is gained by straining this point. It is unwise to put the plants out until the temperatures are safe. Meanwhile the young plants in the frames or houses will require the same careful treatment as the indoor crop. Ventilate the plants when the weather is warm, and keep them close when it is cold and stormy. That is a very obvious statement, but much harm is done to plants every season by neglecting this primary attention. It is, of course, a busy time, but this attention is necessary, and is best met by making it the duty of one person, and placing the frames in as handy a position as possible. Most of the troubles with the young plants are due to their being grown too quickly in a high temperature and a moist atmosphere, when they become a prey to sclerotinia and fungi known as "damping off." With attention, sturdy plants are grown which are easily hardened off later without injury, and are ready to go out into the field at the earliest date without suffering a set-back. The plants are best given one or two bordeaux sprays before planting out, with an interval of about a fortnight. Examine the plants carefully and discard any that show the least sign of disease.

SMALL-FRUITS.

Cape gooseberries, peppers, and egg-plants require attention somewhat similar to that advised for tomatoes. The brakes of bush fruits will need light cultivation in bright weather to keep the weeds down. Strawberry-beds will require spraying with bordeaux where leaf-spot fungus is present; destroy runners and weeds, and give a dressing of nitrates before laying down a straw mulch. Newly planted passion-vines are trained to one stem by pinching out the growing point of laterals; tie the plant to the stake as it grows, until it reaches the horizontal wire.

Preparation of the land for the before-mentioned half-hardy crops (including outdoor tomatoes) should now be completed, harrowing in a dressing of suitable manures a week or two before planting out.

TOBACCO-GROWING.

As the tobacco-plants in the seed-beds attain a size near that required for transplanting they should be hardened by gradually

giving them more air and less water. Avoid sudden changes by removing the cover for a few hours in the morning or on a dull day for a commencement, gradually accustoming the plants to full sunlight and natural conditions, protecting them only in the case of extreme weather conditions. Just before they are ready, spray the plants well with any remedy that may be necessary, and give the beds a good watering the day before planting, so as to facilitate lifting the roots without damage. Lift the plants with as much root and soil as possible, and place them in an upright position in trays for carrying into the field. If dull weather is not available for the work of planting out, it is best done as far as possible during the afternoon.

Plants in the seed-beds now that are making good progress must not be forced with manures, for fear of making them soft and delicate, but if they stop growing and show a tendency to harden they should be encouraged to make growth by feeding them with fertilizers.

Towards the end of October the preparation of the land where the plants are to be grown should be completed by an application of such fertilizers as may be required. The tendency now in planting is to widen the distance between rows and lessen it between plants—a method that gives increased facilities for the later field operations without damage to the leaves ; 3½ ft. between the rows and 2½ ft. or less between the plants is about right. For this method of planting a line is marked out with sighting-rods where a row of plants is to be placed, and a furrow is struck with a hand-plough ; into this furrow the young plants are placed at regular intervals, and the roots then firmly covered.

Every effort should be made to commence planting out early in the season, so that the crop may ripen in warm weather. It will then be of better quality, and be more easily cured than that ripening later.

VEGETABLES.

Main-crop beetroot, carrots, peas, and spinach should now be sown, and late potatoes, cauliflower-plants, and rhubarb planted. As the weather warms, sow marrows, pumpkins, ridge cucumbers, and French, runner, and wax-pod beans. Towards the end of October—for planting out early in the New Year—sow the following important winter crops : Savoy and red cabbage, cauliflower, broccoli, kale, main-crop celery, and leeks. Continue to feed the asparagus-beds monthly with dressings of salt or fertilizers.

LAWNS AND GREENS.

Much attention has been given recently in America and England to the use of sulphate of ammonia on lawns in the spring. Experiments there have shown the advantage of giving at that season fortnightly dressings of this manure mixed with twice its volume of sand, and applied at the rate of 5 lb. to 1,000 sq. ft. (say, 2½ oz. to 1 square yard). Unless the weather was showery the dressings were watered in. The result was that weeds and clovers quickly disappeared, and a sward of fine grasses was obtained. This treatment deserves a careful trial here by all who realize the use and beauty of fine lawns.

—W. C. Hyde, Horticulturist, Wellington.

AGRICULTURAL RESEARCH ABROAD.

DR. REAKES'S MISSION.

DR. C. J. REAKES, Director-General, Department of Agriculture, left Wellington on 27th August for London, where he will represent New Zealand at the Imperial Agricultural Research Conference, which opens on 4th October. The following statement regarding the Conference and Dr. Reakes's further programme of investigation abroad was made before his departure by the Hon. O. J. Hawken, Minister of Agriculture :—

The proposal to hold the Conference originated with the Agricultural Research Council in Great Britain, a body composed mainly of directors of agricultural research institutes in England, Wales, and Scotland, on which also the Ministry of Agriculture, the Board of Agriculture for Scotland, the Development Commission, and the Department of Scientific and Industrial Research of Great Britain are represented ; and when the Secretary of State for Dominion Affairs submitted it to the New Zealand Government it was cordially approved. The delegates to the Conference will consist principally of workers engaged on agricultural research and officers responsible for the administration of agricultural research in the various parts of the Empire. The cost of the Conference itself is being borne by the Empire Marketing Board, and it is expected to last about four weeks, including visits to research institutes, &c.

New Zealand will be represented by Dr. C. J. Reakes, Director-General of Agriculture. In addition, Mr. T. Rigg, of the Cawthron Institute, who left New Zealand some time ago for America and England, is also expected to attend the Conference for part of the time, if not throughout. The Imperial authorities have advised us of the proposed itinerary in connection with the visits to the various research institutes, &c. Among these are the Rothamsted Experimental Station, the Animal Nutrition Institute, and the Plant Breeding Institute, Cambridge; the Animal Breeding Research Department, the Scottish Plant Breeding Station, and the Scottish Animal Diseases Research Station, Edinburgh ; the Dairy Research Institute at Reading ; the Animal Pathology Research Institute at the Royal Veterinary College, London ; the Ministry of Agriculture Veterinary Laboratory, Weybridge ; the Foot-and-mouth Disease Research Station at Pirbright ; the Agricultural Economics Research Institute at Oxford ; the Plant Breeding Station at Aberystwyth ; and the Rowett Animal Nutrition Research Institute at Aberdeen.

Dr. Reakes will also visit Leeds and Bradford, in order to inquire particularly into matters relating to New Zealand wool and to discuss the wool question generally with Professor Barker of Leeds University, with whom the Department has been in correspondence, and to whom sample fleeces of New Zealand wool have been sent.

A special feature of his inquiries and investigations in the United Kingdom and in other countries will be in connection with diseases of dairy cows, which are causing particular trouble in New Zealand as well as in many other countries, and the opportunity of getting into personal touch with those carrying out scientific investigation in connection with these diseases will be most valuable. The work being done in Great Britain, particularly at the Rowett Institute, in connection with mineral contents of pastures and with animal nutrition generally will also be the subject of close inquiry, and it is anticipated that a great deal of good information regarding these will be obtained.

Close inquiry will also be made into the existing conditions regarding foot-and-mouth disease and the research work which is going on in connection with it. The question of the possibility of reopening the export trade in stud stock from Great Britain into New Zealand will receive close attention. Matters relating to our meat-export trade will also be gone into.

Dr. Reakes will give special attention to agricultural education and to the work being done in this direction in agricultural colleges in England and Scotland,

so that any features connected with this which are likely to be of value to us in New Zealand can be made available for those dealing with agricultural education here.

After completing his investigations and inquiries in England he will visit Denmark, Holland, Belgium, and France. In Denmark and Holland particularly a great deal of information should be gained regarding dairy matters; also regarding dairy-cow diseases and the methods of preventive and curative treatment adopted. The progress of agricultural education will also be gone into. In France special matters for inquiry will include the results so far obtained from Dr. Calmette's method of protective inoculation against tuberculosis. Thanks to the courtesy of the Pasteur Institute authorities, some of Dr. Calmette's cultures were obtained some time ago for the Wallaceville Laboratory, where work upon them is being done with a view to testing the method in New Zealand.

Dr. Reakes will also endeavour to meet Dr. Voronoff, and obtain first-hand information regarding the results of his gland-grafting operation as applied to farm animals. He hopes also to visit the agricultural and veterinary colleges and research institutions in France, where it is understood very good work is being done.

He will return to New Zealand via South Africa, where he will make special inquiry into the work being done in connection with the control of and research into animal-disease. The Union Government of South Africa maintains a particularly well-equipped and strongly staffed veterinary research laboratory near Pretoria, and it is anticipated that a great deal of very valuable information can be obtained there.

He will also visit Rhodesia for the special purpose of obtaining first-hand information regarding a special type of vaccine for contagious abortion in cows, which is reputed to have met with a considerable measure of success in that colony. A beginning has been made to test this vaccine in New Zealand, and the information Dr. Reakes hopes to obtain in Rhodesia should prove of great assistance to our workers in New Zealand. This particular vaccine seems to hold out some promise, and it is certainly free from the serious objection of converting inoculated animals into "carriers" of the disease, which has rightly prevented us in New Zealand adopting the use of a live vaccine that was at one time credited with giving good results but now seems to be going out of favour.

From South Africa Dr. Reakes will return to New Zealand, where he expects to arrive about the end of February or the beginning of March.

IMPORTATION OF PIGS.

OWING to the presence of certain diseases it has been necessary for some time past to place an embargo on the importation of pigs from Britain and Australia. Recognizing the importance of new blood being obtained by breeders, the Minister of Agriculture has now decided to allow, during the next few months, the importation of pigs from Canada, subject to the following conditions:—

(1) The written consent of the Minister of Agriculture must be obtained before each shipment is made. Applications for such consent must give full particulars of the pigs proposed to be imported, of the probable date of shipment, and of the owner's name and locality of the farm from which they are to be obtained, in order that full inquiry may be made before consent is given.

(2) If a permit is granted it will be subject to the shipper in Canada giving a statutory declaration that the animals have been in Canada from birth, that they have been free from all contagious disease for six months, and that they have not been in direct or indirect contact with any infected live-stock for six months. They must also be accompanied by a certificate from a qualified veterinarian, and on arrival in New Zealand will be held at one of the island quarantine stations of the Department of Agriculture for forty days.

An Order in Council giving effect to this decision will be gazetted shortly.

WEATHER RECORDS: AUGUST, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE outstanding meteorological feature of August was the frequency with which cyclones passed over or in close proximity to the Dominion, while well-defined high-pressure systems were conspicuous by their absence.

From the 10th to the close of the month there was practically a succession of these cyclones, but, with the exception of one which ruled between the 18th and 21st, they were of a shallow type, accompanied by much rain but little wind. On the 18th and 19th, while the centre of the latter intense disturbance was passing over the North Island, particularly stormy conditions and heavy rain were experienced in the North Island and on the east coast of the South Island.

Except in the Gisborne and Napier districts in the North Island and the western, central, and southermost portions of the South Island, both the aggregate month's rainfall and number of wet days were above the average.

The general character of the month may be described as dull and moist, with an absence of strong winds. Although frosts were frequent, there were few damaging ones. Conditions generally were favourable to a fair growth of grass.

RAINFALL FOR AUGUST, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	6·26	23	1·14	5·10
Russell	4·98	19	0·76	5·07
Whangarei	6·23	24	1·19	6·85
Auckland	6·96	26	1·21	4·19
Hamilton	8·80	20	1·80	4·02
Kawhia	7·84	21	1·57	4·60
New Plymouth	8·68	23	1·50	5·29
Riversdale, Inglewood	11·69	26	1·79	8·65
Eltham	10·49	22	2·50	3·82
Whangamomona	8·97	18	1·15	5·80
Tairua	7·26	23	1·60	6·98
Tauranga	9·72	21	2·27	4·08
Maraehako Station, Opotiki ..	8·46	16	1·94	5·20
Gisborne	3·09	15	1·00	4·55
Taupo	5·69	12	1·53	4·23
Napier	2·15	13	0·96	3·57
Maraekakaho Station, Hastings ..	2·99	16	1·61	3·31
Taihape	3·22	21	0·42	2·73
Masterton	4·54	19	0·90	3·33
Patea	5·10	21	1·09	3·57
Wanganui	3·87	15	1·02	2·73
Foxton	3·48	14	0·50	2·89
Wellington	7·38	23	1·03	4·43
South Island.				
Westport	6·53	19	1·40	6·26
Greymouth	5·62	16	1·09	7·53
Hokitika	7·42	18	1·46	9·34
Ross	6·74	14	1·18	10·40
Arthur's Pass	7·73	15	1·92	12·78
Okuru, Westland	..	..	..	11·46
Collingwood	8·50	21	1·44	6·96
Nelson	7·40	18	0·88	3·02
Spring Creek, Blenheim ..	4·91	18	0·90	2·73

RAINFALL FOR AUGUST, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Tophouse	3·99	13	0·90	4·64
Hanmer Springs	7·37	12	1·64	2·56
Highfield, Waiau	4·40	12	1·16	2·26
Gore Bay	6·20	12	2·25	2·12
Christchurch	2·71	15	0·97	1·83
Timaru	1·30	11	0·32	1·41
Lambrook Station, Fairlie ..	1·40	9	0·50	1·43
Benmore Station, Clearburn ..	0·90	11	0·25	1·50
Oamaru	1·75	11	0·56	1·71
Queenstown	0·74	4	0·36	1·93
Clyde	0·55	6	0·29	0·80
Dunedin	4·02	18	0·90	3·14
Wendon	1·73	9	0·46	2·08
Gore	2·71	16	0·59	2·34
Invercargill	1·64	16	0·26	3·31
Puysegur Point	4·13	16	0·50	7·20

—*E. Kidson, Director.*

EXPORT OF PEDIGREE LIVE-STOCK FROM BRITAIN.

A REPORT issued by the Empire Marketing Board, London, on the progress of its work during the year ended June last, contains the following statement on this subject:—

"One of the principal recommendations in the First Report of the Imperial Economic Committee was that grants should be made out of the Empire Marketing Fund to assist the export of pedigree live-stock to the oversea parts of the Empire. Owing to the prevalence of foot-and-mouth disease in Great Britain, export has been suspended in recent months; but representations were made to the Board by the Royal Agricultural Society of England that the establishment of one or more quarantine stations, through which stock could safely be passed for export to Dominions and colonies, might enable oversea Governments to relax their restrictions on importation. A detailed scheme for the establishment of portal quarantine stations was prepared by the Royal Agricultural Society with the assistance of the Ministry of Agriculture's veterinary experts, and an application was made to the Board for a grant to cover the necessary capital and overhead maintenance charges. The scheme provided for the administration of the English stations by the Royal Agricultural Society, and for their close inspection by the Ministry of Agriculture.

"On being informed that the South African and Southern Rhodesian Governments were willing to admit stock forthwith on the conditions laid down in the scheme, the Board decided to approve the necessary expenditure, and a quarantine station will be established in London at a very early date. In the meantime other oversea Governments are being consulted as to the conditions on which they would be prepared to permit the use of further stations if opened, and the possibility of establishing stations at Glasgow and Liverpool is being explored. The most stringent precautions will be taken by the Ministry of Agriculture for ensuring efficient quarantine methods, and the importing Governments will retain full control over the admission of animals to the stations for export to their own territory. The scheme, which is devised in the interests of home and oversea producers alike, has the hearty support of the principal breed societies, and promises to be a contribution of great value to the Empire's live-stock industry. The Board is now considering whether, and, if so, in what form, a further contribution should be made from the Empire Marketing Fund towards the actual cost of exporting animals to oversea parts of the Empire."

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BANDY-LEGGED LAMBS.

"MACKENZIE COUNTRY," Timaru :—

What is the cause of bandy-legged lambs? Could you suggest anything that could be given the ewes and lambs to eat that would be a preventive? To be of any use it would need to be a practical suggestion, so that it could be put into practice by a person holding, say, 10,000 acres of pastoral country; or something that could be given the sheep in the same manner as we give them rock salt.

The Live-stock Division :—

This bandy-legged condition is one of the symptoms of rickets or deficiency disease. Among the causes is poorness of the phosphate and lime content of the mother's milk, but the condition is chiefly met at weaning-time, when lambs are being fed on pastures the herbage of which is deficient in available lime and phosphoric acid. One preventive is to top-dress some of the better pastures on the run with superphosphate and lime, and to give all the stock periodic spells on this top-dressed country. Licks of which superphosphate and bonemeal form a part are useful in this connection, but before such could be definitely recommended it would be necessary to know exactly in what respect the deficiency exists, as mineral salts other than those mentioned may also be lacking.

MIXING OF LIME AND SUPERPHOSPHATE.

J J., Manurewa :—

A belief is very generally held by farmers that if lime and super are mixed a few days previous to drilling, chemical action is set up that makes the mixture very much more effective than when mixed immediately previous to drilling or when drilled separately. Is there any scientific basis for this belief, or has your Department any evidence in support of it?

The Fields Division :—

Field evidence does indicate that on certain soils lime and super mixed a few days previous to drilling do give better results than when the two ingredients are used separately. The scientific reason ascribed is that when applied to soils with a fair proportion of alumina present superphosphate reverts rapidly to aluminium phosphate. In this form it is less readily available to crops than when reverted by lime. Large areas in Waikato go into this group of soils, and from knowledge of Manurewa—that is, if you are on the heavy clay loam—your soil would also be in the same category. On soils such as the red volcanic soils of Auckland Province a good deal of iron is present, and this reverts the soluble phosphate in the super. In this form the phosphate is less soluble, and therefore less available to plants than either the aluminium or lime combination.

REDWATER AND HÆMATURIA IN CATTLE.

"XJ," Tutaki, Murchison :—

I have a bullock suffering from redwater. He has been running on rough hill country. What is the cause of this disease, and can it be cured? Is it infectious?

The Live-stock Division :—

For about ten or twelve years settlers in the area between Reefton and a little north of Murchison have made occasional and periodical inquiries regarding treatment for redwater. During the past two or three years, however, investigations have proved that a proportion of the cattle (especially milking-cows) in that area are annually affected with a disease known as hæmaturia (bloody urine).

This disease is readily mistaken for what is generally called redwater, and probably your bullock is similarly affected. Hæmaturia has been investigated in several countries, and so far it appears not improbable that it may result from the oxalic-acid contents of the herbage on which the cattle are allowed to graze for some time, or it may be some toxic substance in the pasture. Several forms of treatment have been suggested, but these have not been sufficiently successful to warrant their recommendation. However, experience in France, British Columbia, and elsewhere has shown that following agricultural improvement—such as better drainage, top-dressing with lime and manures, &c.—in the affected areas the disease tends to disappear. Hæmaturia is not considered to be either infectious or contagious. The urine of affected animals may be red or brown in colour, and blood-clots may also be passed. There is a form of redwater which is contagious, this being caused by a parasite in the blood; but, fortunately, this trouble has not so far appeared in New Zealand. Another form of redwater is caused by dietetic errors, such as feeding cows heavily on turnips just before calving, &c. In this form strong doses of common salt in addition to tonics have been used successfully. Further particulars regarding chronic hæmaturia may be obtained from an article published in the *Journal* for August, 1926.

CONVERSION OF RATSTAIL GRASSLAND.

J. C. McGREGOR, Waimana, Opotiki :—

Referring to the article on destruction of tall couch in Marlborough which appeared in the May *Journal*, I would like advice on the following matters: (1) Would the smothering-crop prove as successful if applied to ground (ploughable) which is grassed almost entirely with ratstail? (2) Is there any difficulty in getting the smothering-crop—Algerian oats and Scotch tares—to ripen simultaneously? There are no threshing-mills in this district, so I would have to hand-thresh, and propose using grain and tares as pig-feed. I presume in districts more scientifically farmed the mills separate the two seeds. My ultimate object is to get the land, which is virgin, into good cow-pasture. The soil is river-silt, 6 in. deep, with shingly subsoil; the country is well drained and has a good rainfall.

The Fields Division :—

Tall couch (*Agropyron repens*) is much more aggressive and harmful than ratstail, since it persists in spite of good cultural and cropping methods, and unless it is eradicated completely before putting the land down to grass it is likely to cause trouble. With ratstail, however, it has been found that even when it appears on grassland it can be subdued by top-dressing and good management; hence drastic measures such as allowing the smothering-crops to seed are not necessary. An ordinary smothering-crop of Algerian oats (3 bushels) and spring tares (1 bushel), sown in spring and fed off in late summer, would be a good preparation for the autumn sowing of grass. The following grass mixture is recommended for your country: Cocksfoot, 8 lb.; Poverty Bay rye-grass, 10 lb.; Italian rye-grass, 4 lb.; crested dogstail, 4 lb.; timothy, 3 lb.; meadow-foxtail, 1 lb.; cow-grass, 3 lb.; white clover, 1 lb.: total, 34 lb. per acre. Basic super at 3 cwt. per acre should be sown with the mixture. There would be great difficulty in harvesting Algerian oats and Scotch tares, especially as you have no grain-mill in the district. In Marlborough the tares only were harvested for seed, since the oats acted more as a support for the tares than as a grain-producing crop. If you have a herd of cows, it would be a good plan to feed off the green smothering-crop. As green feed it would be found most useful, and quite equal to the purpose of subduing the ratstail.

ACUTE IRRITATION OF DOG'S FEET.

R. S. ALLAN, Whangarei :—

I own a valuable collie dog, and for some months he has been suffering from sore feet. There are no actual sores on the feet, but they are in an intense state of irritation, and he is constantly gnawing and biting them, almost tearing off the pads. We have bathed them in bluestone solution, but without effect. Can your veterinary branch tell me the cause and the remedy?

The Live-stock Division :—

All breeds of dogs are subject to similar complaints, but breeds with much hair between the claws are more subject, the condition being usually associated

with inflammation between the claws and pads. Probably if you examine closely you will find that this is so. Often the inflammation is associated with an eczematous condition or a cyst between the claws, and this would require surgical treatment. We would advise you first of all to clip the hair carefully between the claws and pads, and thoroughly clean and sponge out with a weak solution of lysol and warm water; then, after everything is clean and dry, dress once with tincture of iodine. Subsequent treatment which might be given would be to sponge or bathe with one part hydrogen peroxide and three of warm water. Do this daily, and afterwards apply a little ointment consisting of equal parts of zinc and boracic ointments. It may be necessary to make a boot out of a piece of stout calico to put on the foot, but this is likely to be torn off unless a muzzle is placed on the dog until it gets accustomed to the boot.

DEVICES FOR BURNING OFF SCRUB.

"SECOND GROWTH," Opotiki:—

Could you tell me if there is any efficient article made for carrying fire for burning off second growth (manuka, fern, &c.) in a condition rather too thin to carry a fire very freely? I often use a flax-stick dipped in kerosene, but the flame is not big enough unless the scrub is very dry and thick.

The Fields Division:—

Several home-made devices are used for setting fire to fern and other dry surface growth, and have given satisfactory results. A piece of pumice soaked in kerosene, and to which is attached a handle made of wire, is simple and effective. The lighted pumice is dragged along through the fern. Another method consists of a piece of gas-pipe with a wick of waste; this is fed by kerosene from the pipe, the top end, held in the hand, being stopped up. In some districts a blow-lamp is favoured by settlers, and acts very efficiently.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 14th July to 8th September, 1927, include the following of agricultural interest:—

No. 55554: Wool-pack lining; M. A. Browne, Christchurch. No. 56292: Tractor-wheel travelling-band coupling; A. McDonald, Takapau. No. 56337: Manure-distributor; C. Houchen, Hamilton. No. 56396: Sheep-shears: H. Wiremu, Whangarei. No. 58282: Milk-sample collector; A. Illingworth, Alton. No. 58465: Retting of flax; J. C. W. Stanley, Victoria, B.C. No. 56884: Electro-culture machine; L. J. A. Trouchet (nominee of J. Christofleau), Perth, W.A. No. 58558: Manure-sowing machine; C. W. U. Sorensen, Hamilton. No. 55978: Automatic cow-feeder; T. E. Larking, Okato. No. 56033: Grain-drill lift; S. Upritchard, Arundel. No. 56140: Threshing-machine attachment; G. E. Barnes, Darfield. No. 56540: Marker for manure-sowing machine; W. F. Griffin, Hatuma. No. 56674: Teat-cup cleaner; C. Christie, Invercargill. No. 57005: Cream-can float; J. L. Crane and others, Whangarei. No. 57183: Concrete fencing-post; R. H. Bird, Napier. No. 57316: Manure-sower; W. T. London, Tauranga. No. 57215: Cow-tail holder; E. Ryan, Masterton. No. 58476: Wire-strainer; T. McKenzie, Otaki. No. 58866: Sheep-shearing machine; J. Davidson, Sydney, N.S.W. No. 57017: Milk-releaser; J. Taylor, Eltham. No. 57403: Manure broadcast distributor; E. Ryan, Masterton. No. 57448: Milk-can; D. Robertson, Wellington. No. 57624: Rabbit-trap; H. S. Ringstad, Marrickville, N.S.W. No. 58418: Casein-drying machine; C. Hope-Johnstone and R. S. Smith, Auckland. No. 58702: Sheep-shears; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 58820: Scutching-machine; Maddren Bros., Christchurch. No. 58956: Milking-machine rubber mouthpiece; C. P. Dinsen, Denmark.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates have been notified by agricultural and pastoral associations :—

Hawke's Bay A. and P. Society : Tomoana, 19th and 20th October, 1927.
Poverty Bay A. and P. Association : Gisborne, 25th and 26th October.
Wairarapa A. and P. Society : Carterton, 26th and 27th October.
Timaru A. and P. Association : Timaru, 26th and 27th October.
Manawatu A. and P. Association : Palmerston North, 1st, 2nd, and 3rd November.
Kelso A. and P. Association : Kelso, 2nd November.
Northern A. and P. Association : Rangiora, 4th November.
Canterbury A. and P. Association : **Royal Show,** Christchurch, 9th, 10th, and 11th November.
Waimate A. and P. Association : Waimate, 15th November.
Egmont A. and P. Association : Hawera, 16th and 17th November.
North Otago A. and P. Association : Oamaru, 17th and 18th November.
Otago A. and P. Society : Dunedin, 23rd and 24th November.
Stratford A. and P. Association : Stratford, 23rd and 24th November.
Tokomairiro Farmers' Club : Milton, 28th November.
Clutha and Matau A. and P. Society : Balclutha, 1st and 2nd December.
Auckland Metropolitan A. and P Association : Auckland, 2nd and 3rd December.
Wyndham A. and P. Association : Wyndham, 9th December.
Otago Peninsula A. and P. Society : 10th December.
Nuhaka A. and P. Association : Nuhaka, 1st January, 1928.
Marton District A. and P. Association : Marton, 18th January.
Waipukurau A. and P. Association : Waipukurau, 20th January.
Horowhenua A. and P. Association : Levin, 24th and 25th January.
Tapanui Farmers' Club : Tapanui, 25th January.
Rangitikei A. and P. Association : Taihape, 25th and 26th January.
Golden Bay A. and P. Association : Motupipi, 1st February.
Woodville A. and P. Association : Woodville, 3rd and 4th February.
Clevedon A. and P. Association : Clevedon, 4th February.
Feilding A. and P. Association : Feilding, 7th and 8th February.
Dannevirke A. and P. Association : Dannevirke, 8th, 9th, and 10th February.
Hikurangi-Otonga A. and P. Association : Hikurangi, 9th February.
Masterton A. and P. Association : Solway, 14th and 15th February.
Te Awamutu A. and P. Association : Te Awamutu, 15th February.
Taumarunui A. and P. Association : Taumarunui, 15th February.
Tauranga A. and P. Association : Tauranga, 22nd February.
Ohura A. and P. Association : Matiere, 22nd and 23rd February.
Franklin A. and P. Association : Pukekohe, 24th and 25th February.
Hukerenui Agricultural Association : Hukerenui, 1st March.
Mongonui County A. and P. Association : Kaitaia, 3rd March.
Opotiki A. and P. Association : Opotiki, 6th March.
Taranaki Agricultural Society : New Plymouth, 7th and 8th March.
Matamata A. and P. Association : Matamata, 13th March.
Kaikoura A. and P. Association : Kaikoura, 16th March.
Mayfield A. and P. Association : Mayfield, 17th March.
Hawarden A. and P. Association : Hawarden, 23rd March.
Methven A. and P. Association : Methven, 29th March.
Oxford A. and P. Association : Oxford, 5th April.

Subsidy for Destruction of Kea.—The subsidy of 5s. per beak paid by the Department of Agriculture for kea-destruction totalled £766 15s. for the official year 1926-27. This represented 3,067 birds, a decrease of 830 on the preceding year.

Water Content of Export Butter.—During the year ended 31st March last the Dairy Division tested 133,206 churnings. The average water content was 15·15 per cent., compared with 15·17 per cent. in 1925-26. The number of churnings found to be over the legal limit (16 per cent. of water) represented 0·694 per cent. of the total. These were returned to the respective factories to be reworked with drier butter.

The New Zealand

Journal of Agriculture.

VOL. XXXV. WELLINGTON, 20th OCTOBER, 1927. No. 4.

DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF 1926–27 SEASON.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

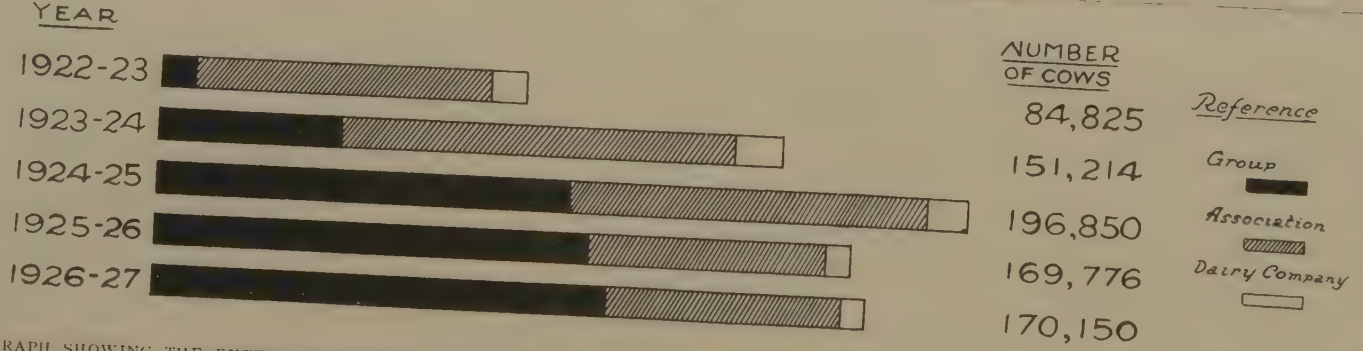
THE support accorded to dairy-herd testing in New Zealand during the season 1926–27 has been such as to result in a slight increase in the total number of cows tested compared with the preceding season. The increase is made of more importance when one takes into consideration the fact that the total number of cows in milk and dry in the Dominion decreased between 1925 and 1927 by some 28,000. For the purposes of this review a dairy cow is classed as a tested cow when she has been tested twice or more during the season. On this basis the number of cows under herd-test during 1926–27 stands at 170,150, as against 169,776 for 1925–26, an increase of 374 cows, or 0·2 per cent. The 170,150 tested animals represent 13 per cent. of the total of our dairy cows in milk and dry.

Considered under the headings of the three systems of herd-testing recognized in the Dominion, Group testing shows an increase of 4,600 cows, Association testing a decrease of 2,522, and Dairy Company testing a decrease of 1,704 Details of this classification for the past five seasons are supplied in Table 1. The accompanying graph, covering the same period, gives a clearer conception of the relative extent of the testing as a whole and according to system.

Table 2 presents an interesting subdivision, providing a classification of tested cows according to land districts, the last five seasons being included. The table would have been more interesting could we have shown separately, for comparison, the number of cows in milk and cows dry in each land district, but, unfortunately, these statistics for 1926–27 are not yet available. As the table shows, Auckland still leads in possessing the greatest number of tested cows. A gratifying feature is the much improved position of Canterbury. Despite a small increase this year, Otago's position is still very disappointing; it is also regrettable that Southland did not maintain the comparatively high standard reached last season. It will be observed that the total number of tested cows in the North Island decreased by 753, while the South Island showed an increase of 1,127.

Table 1.—Number of Cows tested Twice or more, classified according to Season and System of Testing.

System.	1922–23.			1923–24.			1924–25.			1925–26.			1926–27.		
	Associations, &c.	Cows.	Average Cows per Association, &c.	Associations, &c.	Cows.	Average Cows per Association, &c.	Associations, &c.	Cows.	Average Cows per Association, &c.	Associations, &c.	Cows.	Average Cows per Association, &c.	Associations, &c.	Cows.	Average Cows per Association, &c.
Association ..	90	67,835	754	114	96,198	844	117	87,695	750	124	59,345	479	116	56,823	489
Group ..	6	7,500	1,250	34	43,144	1,269	91	100,055	1,100	86	105,227	1,224	96	109,827	1,144
Dairy Company	46	9,490	206	42	11,872	283	51	9,100	178	38	5,204	137	28	3,500	125
All ..	142	84,825	597	190	151,214	796	259	196,850	760	248	169,776	685	240	170,150	709



GRAPH SHOWING THE EXTENT OF HERD-TESTING IN NEW ZEALAND FOR LAST FIVE YEARS- AS A WHOLE AND ACCORDING TO SYSTEM.

Table 2.—Number of Cows tested Twice or more, classified according to Season and Land District, &c.

Land District, &c.	Cows tested Twice or more.				
	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.
North Auckland ..	17,973	23,521	31,049	24,951	24,616
Auckland	32,123	63,945	93,912	77,651	82,338
Gisborne	2,419	3,122	4,022	3,891	2,626
Hawke's Bay ..	1,629	4,391	5,468	4,902	2,987
Taranaki	15,585	18,567	16,840	16,485	14,696
Wellington	12,962	30,584	37,415	29,653	29,517
North Island ..	82,691	144,130	188,706	157,533	156,780
Nelson	..	1,192	574	880	620
Marlborough ..	105	175	147	441	258
Westland	..	771	..	...	74
Canterbury	1,400	2,345	2,171	1,799	4,292
Otago	499	2,416	1,859	903	950
Southland	130	185	3,393	8,220	7,176
South Island ..	2,134	7,084	8,144	12,243	13,370
Dominion	84,825	151,214	196,850	169,776	170,150

Table 3 gives the numbers of cows, herds, and associations, together with the average size of herds and associations, represented in all effective annual summaries (on the 100-days-or-more basis) received for the past three seasons. The term "association" as used in this table denotes a herd-testing organization, whether Group, Association, or Dairy Company. As pointed out in a previous review, there is, unfortunately, a confusion in herd-testing nomenclature, inasmuch as organizations operating under either the Group or the Association system are termed "herd-testing associations," or simply "associations."

Table 3.—Number of Cows, Herds, and Associations represented in Effective Seasons' Summaries received. (Basis: All Cows in Milk 100 Days or over.)*

	1924–25.	1925–26.	1926–27.
Number of associations	190	201	211
Number of herds	4,815	4,458	4,678
Number of cows	151,875	146,398	155,028
Average number of herds per association..	25	22	22
Average number of cows per herd ..	32	33	33
Average number of cows per association	799	728	734

* Including both Group and Association systems, and on basis of sections or units.

Table 4 supplies a classification of groups and associations according to herds and cows. It will be noted that the associations have a tendency to grow smaller, whereas the groups remain more uniform.

Table 4.—Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System.	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association ..	1924–25	25	574	23
	1925–26	19	407	22
	1926–27	18	408	22
Group ..	1924–25	26	1,185	45
	1925–26	27	1,205	44
	1926–27	26	1,127	43

In the groups the herds are about twice as large as in the associations, possibly mainly because the Group testing rules insist upon the inclusion of all sound cows, whereas the Association system often represents a selection. This does not necessarily mean a selection of the better cows in the herd, but that often only cows previously untested are offered, or cows which the owner specially desires tested. There is also the influencing factor that group testing can be operated most economically in districts where the herds are large.

AVERAGE YIELD OF TESTED COWS.

Effective summaries received for the 1926–27 season represent 91·1 per cent. of the total number of cows tested twice or more for all groups and associations. Opportunity is here taken to record our appreciation of the prompt and accurate manner in which the various herd-testing officers have complied with the request for summaries of results. Every person communicated with responded, and, as will have been noted, in less than 9 per cent. of the cases were the summaries incomplete or obviously unreliable. Production summaries are requested on the basis of all cows in milk 100 days and over, and the numbers so represented in the effective summaries received for the past season total 155,028 cows, as against 146,398 for the preceding season.

Table 5 is a grand summary of production results for the past two seasons. The most conspicuous feature of this table is the increase of some 20 lb. of butterfat in the production of the average tested cow. This is certainly a material improvement. Although doubtless an exceptionally favourable season accounted for much of the increase, it is equally certain that due credit should be given to the influence of herd-improvement.

Table 6 supplies a comparison of average production according to system of operation. It will be noticed that the yield of the average cow on Association test has improved by some 17 lb. of butterfat, while the Group average has increased by almost 21 lb. It will also be observed that the average days in milk increased by three for Association test, and by five for the Group method.

In Table 7 have been collected production results under the headings of cows in milk 100 days or more, and cows in milk 210 days or

Table 5.—Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

	1925-26.		1926-27.	
	Days in Milk.	Butterfat-production.	Days in Milk.	Butterfat-production.
		lb.		lb.
Average for all cows (146,398 in 1925–26 and 155,028 in 1926–27)	230	220·51	236	240·48
Highest Association or Group average ..	263	323·24	240	357·46
Lowest Association or Group average ..	168	153·14	131	94·88
Highest herd average	233	500·21	317	511·91
Lowest herd average	125	51·69	100	65·13
Highest cow	286	819·85	276	795·09
Lowest cow	120	11·13	103	17·44
Average daily production of butterfat for all cows	..	0·96	..	1·02

Table 6.—Average Production of all Effective Results for Past Two Seasons classified according to System. (Basis: All Cows in Milk 100 Days or over.)

Season.	System.	Number of Associations or Groups.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat.
						lb.
1925–26 ..	Association	120	2,239	48,823	217	215·40
	Group ..	81	2,219	97,575	236	223·06
1926–27 ..	Association	115	2,140	46,878	220	232·64
	Group ..	96	2,538	108,150	241	243·88

Table 7.—Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more.

Year.	100 Days or more.		210 Days or more.	
	Average Days.	Average Butterfat.	Average Days.	Average Butterfat.
		lb.		lb.
1922–23	227	232·99	261	271·48
1923–24	227	221·39	258	267·10
1924–25	223	231·51	258	266·29
1925–26	218	221·19	257	259·20
1926–27	236	247·35	262	273·36

more. These figures are based on results from associations tested by Dairy Division officers, similar information for cows tested in privately-controlled organizations not being available. This type of summary has certain advantages, inasmuch as it provides an indication of production over a period more in conformity with that of the length of a dairying season. The 100-days-or-more summary has the advantage that it includes records for some cows of such poor quality that

Table 8.—Average Production, according to Land Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained. (Basis: All Cows in Milk 100 Days or over.)

Land District, &c.	1923–24.			1924–25.			1925–26.			1926–27.		
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	Cows in Summary.	Average Days in Milk.	Average Butterfat.
			lb.			lb.			lb.			lb.
North Auckland	16,270	210	200·23	25,685	216	205·14	20,925	224	210·94	21,471	224	232·46
Auckland	48,253	234	207·86	77,003	235	224·98	73,101	236	226·08	78,625	240	244·82
Gisborne	2,026	209	202·16	3,455	204	208·34	3,368	212	191·03	2,405	217	218·08
Hawke's Bay	1,790	231	228·34	4,575	243	233·25	4,204	224	189·32	2,285	230	208·95
Taranaki	13,377	233	246·66	11,683	233	251·58	12,846	235	242·42	12,857	241	239·67
Wellington	22,402	237	215·60	24,199	228	230·99	22,043	223	212·64	25,400	258	250·53
North Island ..	104,118	232	213·56	146,600	230	224·48	136,577	231	221·11	143,043	240	252·29
Nelson	235	195	204·93	104	258	283·16	600	192	207·16	261	233	239·27
Marlborough	..	..	..	..	..	..	..	..	..	..	..	..
Westland	..	..	..	..	..	..	..	..	..	..	..	..
Canterbury	1,483	191	199·76	909	196	213·15	391	195	217·21	3,917	207	216·03
Otago	1,849	196	193·73	1,249	204	203·04	804	218	223·60	820	199	247·02
Southland	122	204	210·91	3,013	191	187·28	8,017	217	211·14	6,987	217	215·30
South Island ..	3,659	194	197·47	5,275	197	197·36	9,821	214	212·15	11,985	213	219·66
Dominion	107,777	230	213·01	151,875	229	223·54	146,398	230	220·51	155,028	238	241·66

Table 9.—Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Seasons 1925–26 and 1926–27. (Basis: In Milk 100 Days or over.)

System.	Class Limits (in Pounds of Butterfat).																Total Number of Cows classified.
	Under 50.	50–100.	100–150.	150–200.	200–250.	250–300.	300–350.	350–400.	400–450.	450–500.	500–550.	550–600.	600–650.	650–700.	700–750.	750–800.	800–850.	
							Numbers.											
1925–26.																		
Association ..	122	2,207	7,853	11,351	11,488	8,211	4,293	1,745	582	163	46	9	2	..	..	..	1	48,073
Group ..	285	3,610	12,133	22,886	25,738	18,306	9,565	3,620	1,067	282	55	11	11	4	1	1	..	97,575
Both ..	407	5,817	19,986	34,237	37,226	26,517	13,858	5,365	1,649	445	101	20	13	4	1	1	1	145,648
							Percentages.											
Association ..	0·25	4·59	16·34	23·61	23·90	17·08	8·93	3·63	1·21	0·34	0·10	0·02	*	..	..	..	*	48,073
Group ..	0·29	3·70	12·43	23·45	26·38	18·76	9·80	3·71	1·09	0·29	0·06	0·01	0·01	*	*	*	..	97,575
Both ..	0·28	3·99	13·72	23·51	25·56	18·21	9·51	3·68	1·13	0·31	0·07	0·01	0·01	*	*	*	*	145,648
							Numbers.											
1926–27.																		
Association ..	42	1,653	6,090	9,441	10,855	8,903	5,545	2,663	954	289	75	23	7	2	..	..	..	46,542
Group ..	89	2,251	8,946	19,098	26,396	23,644	15,035	7,010	2,603	799	203	47	9	4	..	2	..	106,136
Both ..	131	3,904	15,036	28,539	37,251	32,547	20,580	9,673	3,557	1,088	278	70	16	6	..	2	..	152,678
							Percentages.											
Association ..	0·09	3·55	13·08	20·28	23·32	19·12	11·91	5·72	2·04	0·62	0·16	0·04	0·01	*	..	..	..	46,542
Group ..	0·08	2·12	8·42	17·99	24·86	22·27	14·16	6·60	2·45	0·75	0·19	0·04	*	*	..	*	..	106,136
Both ..	0·08	2·55	9·84	18·69	24·39	21·31	13·47	6·33	2·32	0·71	0·18	0·04	0·01	*	..	*	..	152,678

* Data occurring, but relatively insignificant.

their lactation periods fall short of 210 days. On the other hand, it has the disadvantage of including certain cows which should perhaps be omitted—cows that have died, fallen sick, been sold, or for some other reason have been discontinued some time before their testing would have been completed.

Table 8 enables those interested to compare average production by land districts. It will be noticed that in every instance except one there has been an increase in average production, the exception being Taranaki.

In studying these production tables readers must not overlook the fact that they represent the yield of tested cows, and not of all cows in New Zealand, and thus show our dairy cow in the most favourable light. As a general rule, though, needless to say, not without many exceptions, only the better herds are tested; and even in the tested herds many of the poorer cows are retained for only a short period after the season's testing commences. While for 1926–27 the average tested cow in New Zealand produced 241·66 lb. of butterfat, the average dairy cow, comprising all cows in milk and dry, yielded only some 200 lb.

Table 9 supplies an analysis of individual records, and is useful for indicating just how many cows may be considered profitable and how many unprofitable. Similar figures for 1925 26 are included for purposes of comparison. As might be expected, the tables agree in respect that the greatest number of records fall within the 200-250 lb. butterfat division. It is pleasing to note, however, the considerably decreased percentage of cows in the first four subdivisions, and particularly in the three lowest grades.

THE FUTURE.

Herd-testing, like many other enterprises, has suffered from prevailing economic stringency. But herd-testing is too well established and too essential to lapse for a protracted period. There are indications that it is again on the upward trend, and we may anticipate that future years will witness the testing of a steadily increasing proportion of our dairy cows. The recently approved State financial assistance of £8,000, to be expended during the current season, will doubtless do much to assist in promoting herd-testing, and should afford practical relief to many farmers who are finding the fees a difficulty.

Lice-infested Sheep.—The Director of the Live-stock Division remarks in his annual report for 1926–27 as follows: Sheep affected with lice are still too numerous, and far too many prosecutions for exposing lice-infested sheep at saleyards have had to be taken. Notwithstanding these the position has not improved, and it would seem that if it is to be remedied more drastic action is required. It was pointed out in my last report that the Inspector has the power to order the withdrawal of lice-infested sheep from sale, and with the view to stopping the practice in question it is proposed that all Inspectors be instructed to see that such sheep are withdrawn. It does not follow, however, that when this action is taken it will relieve the owner of the sheep from prosecution.

PARASITIC CONTROL OF SHEEP MAGGOT-FLIES.

ESTABLISHMENT OF *ALYSIA MANDUCATOR* IN NEW ZEALAND.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE work of establishing the blow-fly parasite *Alysia manducator* in New Zealand has made definite progress since publication of an introductory note on the subject in this *Journal* for January last.

Three consignments of parasitized blow-fly puparia were received from the Imperial Bureau of Entomology, London, during November, 1926, and in early and late January, 1927, respectively. The first and third consignments were sent by parcels-post, and the second in cool storage on board ship. The puparia were packed in damp moss in wooden boxes wrapped with waxed paper.

On arrival of the first consignment, consisting of 1,150 puparia, the adults of *Alysia* were emerging and very active: a total of 102 parasites was secured from this consignment. When opened, the *Alysia* in the second consignment, though carried in cool storage, had commenced to emerge, but were not very active: this consignment contained 1,700 puparia, but only 50 *Alysia* in all were secured from it. In the third consignment the conditions of moisture were excessive, so that a considerable proportion of the puparia had become flattened and damaged. Though this was the largest consignment, containing 2,200 puparia, a total of only 80 *Alysia* was secured.

From these consignments, therefore, a total of 232 *Alysia* developed, of which 60 per cent. were females. As the *Alysia* emerged they were placed in cages containing maggots, which they immediately attacked. Large supplies of maggots were kept available by exposing liver to the different species of blow-flies. It was found that of the latter the maggots of the golden-haired blow-fly (*Calliphora stygia*), the European bluebottle (*C. erythrocephala*), the European greenbottle (*Lucilia sericata*), and the Australian greenbottle (*Chrysomya rufifacies*) were readily parasitized, and in them *Alysia* carried through to the next generation. This is of considerable importance, since *C. stygia*, *L. sericata*, and *C. rufifacies* are the species damaging sheep in New Zealand.

It is also noteworthy that attempts to parasitize the small native bluebottle (*Calliphora icela*) have so far failed, *Alysia* not even attempting to oviposit in the maggots. This is in keeping with the results secured when maggots of all the species mentioned were exposed in the one cage to *Alysia*. Among the blow-flies emerging on that occasion were numerous *icela* and very few of the other species, while sufficient *Alysia* were secured for field distribution. It was found that the cycle of *Alysia* from egg to adult varies from six to eight weeks.

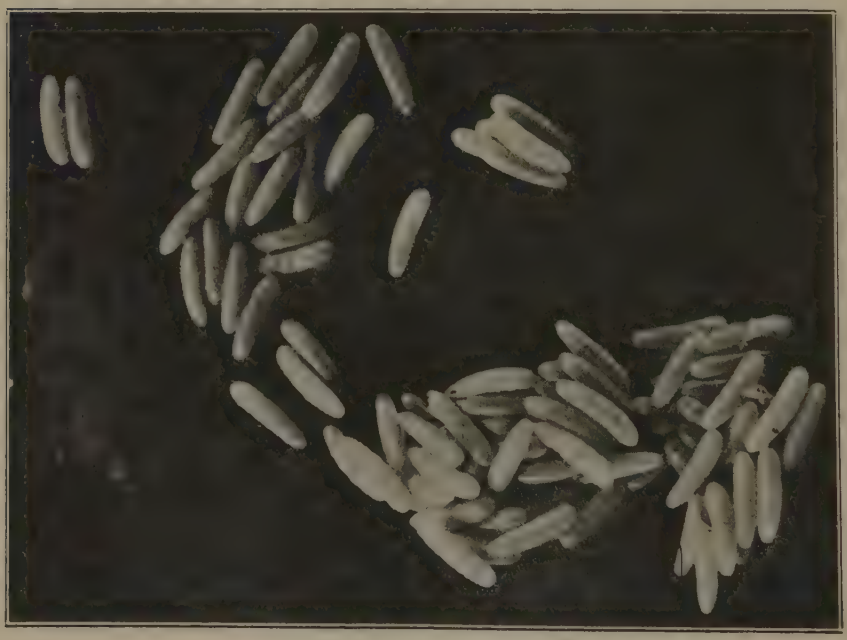
The first New-Zealand-reared generation of *Alysia* commenced to emerge on 3rd January, 1927, and from then until April generations were periodically secured. Field liberations were made from January to March as follows:—

First: 5th January, at "Avondale," Blenheim.
Second: 11th January, at Mount Somers, Canterbury.

Third: 5th February, at "Avondale."
Fourth: 7th March, at "Avondale."
Fifth: 14th March, at "Avondale."
Sixth: 14th April, at Weraroa.
Seventh: 25th April, at Kaitaia, North Auckland.

The liberations were made on maggot-infested carcases under natural conditions in the field. Mr. C. G. Teschemaker, of "Avondale," on being notified some days beforehand that a consignment of *Alysia* was being sent, had a sheep killed on each occasion and well infested with developed maggots at the time the parasites arrived. At Weraroa the *Alysia* were liberated on an accumulation of maggot-infested offal, while the Kaitaia liberation was made on an ox-carcase infested mainly with larvæ of the Australian greenbottle.

That *Alysia* successfully passes the winter in New Zealand is certain, at least in the insectaries, where on 20th September this year the first of the spring generation emerged from infested puparia. The numbers of this first emergence reached a maximum on 30th September, but to date (6th October) have fallen off considerably. What is happening in the field is not yet known; there are several factors to which *Alysia* will be exposed under natural conditions that might seriously hamper its development. One such factor is the presence of other parasites. Among these is *Mormoniella (Nasonia) brevicornis*, which, according to Dr. G. A. K. Marshall, interferes with *Alysia* in England; another parasite is a braconid (*Phaenocarpa* sp.), identified by the Imperial Bureau of Entomology, which in New Zealand parasitizes the golden-haired blow-fly in the same way as does *Alysia*



BLOW-FLY EGGS, MAGNIFIED.

[*Photo by H. Drake.*

DAIRY-FARMING ECONOMICS.

(Continued.)

SURVEY OF A RAGLAN COUNTY FARM GROUP, SEASON 1926–27.

E. J. FAWCETT, M.A., Fields Division, Wellington.

Introductory Notes on the Raglan District.

THE greater portion of the district under review was taken up from the Government in the "sixties." At that time a considerable portion was covered with bracken fern, with manuka on the drier knolls. When the bracken was burnt off preparatory to cultivation logs were exposed, so that originally this country had evidently been under forest. The bush is principally heavy rimu, totara, tawa, and tanekaha, while the moister flats support good stands of kahikatea even at the present time.

Wheat was the main crop of the earlier settlers, this being put in with the spade, and shiploads of wheat were sent to Auckland and to Australia. Much of the land was virtually cropped out at that time. Cattle-raising soon followed, and before many years sheep flocks were general. Last year's returns gave the number of sheep in Raglan County as 268,000, with an average clip of 8½ lb. wool. Raglan is therefore the leading sheep-farming county in the Auckland Land District, and has the further distinction of carrying 592 sheep per 1,000 acres, a figure far in excess of any other Auckland county.

The dairy industry commenced in 1902 with the opening of a small factory at Te Mata by Mr. W. J. Smith. In 1905 the Raglan Co-operative Dairy Co. erected its first factory at Kauroa. In 1911 the establishment was removed to Raglan, and this factory at the present time takes the bulk of the cream produced in the locality.

There is no great variation of soils. For the most part the land is gently rolling to steep, and the soils heavy red volcanic clays residual from the basaltic and andesitic rocks which form the Karioi Mountain. Limestone outcrops appear at various points, as do also conglomerate volcanic rocks and sandstones. Most of the clay soils are heavy, retentive, and sticky when sodden; likewise they tend to dry out in the summer and under the influence of winds. The pastures are noticeable for their dense green colour, and clover-growth is very strong. Good crops of swedes, rape, and maize are grown, and early crops of hay and ensilage can be harvested.

Gorse and blackberry were introduced in the "seventies," and have spread very considerably. At the present time hundreds of acres are covered with giant gorse. The method of dealing with this weed is to cut and burn, plough, and crop with swedes. A second crop of soft turnips or rape is usually taken off, and the land made ready for grassing in the autumn. Various modifications of this system are practised, but usually gorse land receives three ploughings before being permanently grassed. Scattered gorse in pasture land is grubbed out and burnt.

Very little top-dressing of pastures was practised before 1914. Up till then the inward shipments of fertilizers at the Port of Raglan amounted to some 300 to 400 tons annually, most of which was used on the swede crop. In 1920 the quantity had increased to 787 tons, and in 1926 to 1,357 tons, this indicating the growth of the dairy industry. During the last two years considerable quantities of manure have been sent in from Hamilton as back-loading on the lorries which collect cream that is supplied to the Waikato dairy companies.

In 1921 the outward shipments of butter amounted to 91 tons, and in 1926–27 this had increased to 263 tons. From 1925 a larger quantity of cream has been sent out to the Waikato.

Dairying may be said to be still in its youth in this locality. Herd-testing has not come fully into vogue; therefore there has been little culling of unprofitable cows, and no guide as to what calves should be saved for replacements. Last season, however, a commencement in systematic herd-testing was made. With

its inception, the added use of phosphatic manures, and the more scientific management of grasslands, dairy farms here should soon compare with any others in the Auckland District. Basic manures are generally advisable for the stiff clay soils that comprise the greater portion of the area under review.

The average rainfall of 55·58 in. per annum is evenly distributed, thus favouring the dairy industry. The monthly average precipitation is as follows: January, 3·70 in.; February, 3·30; March, 3·20; April, 4·57; May, 4·94; June, 6·53; July, 6·19; August, 4·69; September, 3·66; October, 5·59; November, 3·87; December, 4·34. For the year ended December, 1926, the fall was 57·64 in. Moderate sea-breezes are experienced throughout the year, and hard frosts are exceptional.

Raglan Township is distant thirty miles from Hamilton by a good metalled road, which has been gazetted a main highway. The highest point on this road is 650 ft. above sea-level. The Northern Steamship Co. runs a weekly service with the Port of Onehunga. The output of the Raglan Dairy Co. is shipped to Onehunga, and most freight is brought in by sea. Cattle and sheep, on the other hand, find their markets in the Waikato.

—G. W. Wild, B.Ag., Instructor in Agriculture, Auckland.

General Description of Farm Group.

The group to which this survey pertains is comprised of twenty-six farms, sixteen of which are entirely devoted to dairying, while on ten mixed dairy and sheep farming is practised. As indicated by Mr. Wild in his introductory notes, the district is in a state of active development. Very rapid improvement, however, cannot be expected, owing to the limited earning-capacity of the land, coupled with restricted financial resources.

On those farms devoted to dairying 68 per cent. of the land is in use, but even of this a certain proportion provides only feed for wintering or for dry stock. Where sheep are carried in addition to cows 88 per cent. of the land is being used, although much of it is partially occupied by fern and manuka. It would appear that an additional 20 per cent. of the area on the dairy farms could be used for sheep without affecting butterfat-production. The average area of the dairy farms is 173·8 acres, ranging from 60 to 370 acres, while that of the mixed farms is 387·1 acres, ranging from 84 to 792 acres. Root crops are grown in most cases on the first furrow preparatory to putting new land into grass. The area cut for hay per 100 acres is 9·3 and 7·4 acres respectively. Herd replacement is lower in this district than is the case on the high-producing Waikato plains, the average for all farms in the group being 12·61 per cent. The carrying-capacity of the whole group is practically the same if reduced to sheep capacity on the basis of seven sheep equalling one cow. All the farms supply butter-factories.

Table 1.—Miscellaneous Data per 100 Acres.

	Root Crops.	Hay or Ensilage.	Herd Replacement.	Sheep-carrying Capacity (1 Cow = 7 Sheep).	Area in Use.	Cows per 100 Acres on Cleared Area.	Butterfat-production per 100 Acres cleared.
	Acres.	Acres.	Per Cent.		Acres.		lb.
Dairy farms ..	7·562	9·312	13·22	158·375	68	33·272	6,430·206
Mixed farms ..	7·900	7·400	11·72	157·860	88	..	..

FIG. I. TYPICAL COUNTRY IN RAGLAN DISTRICT.

The large proportion of non-producing land on the farms may be seen from this and some of the accompanying photos.

[*Photo by H. Drake.*

Labour employed.

The major farming operations are performed by the family, outside help being but rarely employed on milking, but rather on improvement works. Table 2 shows the amount of labour employed and the "wage capacity" per 100 acres for each unit. Wage capacity represents the surplus after all expenses have been met and interest at 7 per cent. on personal capital deducted. Shearing, crutching, &c., have been charged direct to Sheep Account, and do not appear in this summary.

Table 2.—Family per 100 Acres, and Number employed.

—	1. Total Family.	2. Hired Labour (Permanent).	3. Children helping.	4. Family Adults working.	5. Total Units of Labour.	6. Wage Capacity per Unit. £	s.	d.
Dairy farms ..	2·555	0·144	0·283	0·807	1·237	68	7	3
Mixed farms ..	1·292	0·130	0·335	0·335	0·800	66	2	6

Production and Expenses per 100 Acres.

Tables 3 and 4 show carrying-capacity, production, and costs per 100 acres on dairy and mixed farms respectively. Dairy farms have been subgrouped in fours from the highest to the lowest production of butterfat per acre, the figures given representing the averages for each subgroup of four farms. To allow of comparison with the figures of the Piako County group published in the August *Journal*, butterfat has been valued at 1s. 4d. per pound, interest on all capital charged at 6 per cent. plus 1 per cent. sinking fund, and labour at £7 per cow.

Table 4 pertains to ten mixed farms divided into two groups of five farms each. In this case labour cannot be considered on a per-cow basis, but is shown as wage capacity per 100 acres only.

Analysis of Dairy-farm Figures.

The position of these farms is summarized in Table 3. It should be noted that column No. 1 gives the actual average area of the farms within each subgroup. As the size of farms increases, production per acre decreases, indicating the superiority of small areas of this class of country when devoted entirely to dairying. Carrying-capacity is considerably higher, resulting in a higher per-acre production. The proportion of unused land is smaller, and allows of more concentrated effort on improvement. The drawback of small areas, however, is that the wage capacity is barely sufficient to maintain a family, improvements therefore depending on the labour of the owner rather than on a capital or revenue expenditure.

Carrying-capacity.

The number of cows milked per 100 acres varies from 35 to as low as 11·3, or from 2·85 to 8·85 acres per cow, with an average of 4·44

Table 3.—Position of Dairy Farms per 100 Acres.

(Four subgroups of four farms each; averages on basis of Government valuation; interest at 6 per cent., plus 1 per cent. sinking fund; wages, £7 per cow.)

Subgroup.	1. True Area.	2. Cows milked.	3. Total Butterfat.	4. Butterfat per Cow.	5. Returns from: Butterfat at 1s. 4d. per Pound.	5. Returns from: Pigs.	5. Returns from: Cattle.	5. Returns from: Total.	6. Capital Value of Land, Stock, and Plant.	7. Expenses: Interest.	7. Expenses: Labour.	7. Expenses: Upkeep and Running.	7. Expenses: Total.	8. Profit.	9. Loss.	10. Production Costs per Pound of Butterfat.	11. Wage Capacity.	12. Wages per Cow.	13. Manure for Top-dressing.	14. Manure per Cow.
	Acres.		lb.	lb.	£	£	£	£	£	£	£	£	£	£	£	d.	£	£	Tons.	Cwt.
1 ..	84·8	33·625	6422·05	190·990	428	50·250	43·0*	524·750	2502·5	175	235	188·250	598·250	..	73·500	22·4	161·500	4·802	13·650	8·119
2 ..	146·5	22·150	4725·95	213·270	315	30·750	19·0*	377·250	1877·5	131	155	134·250	420·250	..	43·000	21·4	112·000	5·056	8·675	7·833
3 ..	207·0	20·850	3950·10	189·450	263	22·500	3·5*	292·500	1715·0	120	146	116·750	382·750	..	90·250	23·3	55·750	2·674	8·475	8·130
4 ..	256·8	13·875	2394·05	172·544	160	10·750	16·5	187·250	1225·0	86	97	92·250	275·250	..	88·000	27·6	9·000	0·649	7·450	10·739
General average	173·8	22·625	4372·54	193·261	291	28·503	20·5*	345·437	1830·0	128	158	132·875	418·875	..	73·438	23·2	84·562	3·737	9·563	8·454

* Losses experienced in these subgroups.

Table 4.—Position of Mixed Sheep and Dairy Farms per 100 Acres.

(Two subgroups of five farms each; averages on basis of Government valuation; interest at 6 per cent., plus 1 per cent. sinking fund.)

Subgroup.	1. True Area.	2. Cows milked.	3. Butterfat: Total.	3. Butterfat: Per Cow.	4. Sheep wintered.	5. Returns from: Butterfat at 1s. 4d. per Pound.	5. Returns from: Pigs.	5. Returns from: Cattle.	5. Returns from: Sheep.	5. Returns from: Total.	6. Capital Value of Land, Stock, and Plant.	7. Expenses: Interest.	7. Expenses: Upkeep and Running.	7. Expenses: Total.	8. Wage Capacity.	9. Manure used.
	Acres.		lb.	lb.		£	£	£	£	£	£	£	£	£	£	Tons.
1	286·8	15·64	2704·54	172·925	51·0	180	22	12·0*	34·4	252·0	1656	116	91·2	207·2	44·8	5·68
2	487·4	6·52	1482·58	227·385	109·2	98	18	31·4*	66·2	213·8	1184	83	70·8	153·8	60·0	5·14
General average ..	387·1	11·08	2093·56	188·949	80·1	139	20	21·7*	50·3	232·9	1420	99	81·0	180·0	52·9	5·41

* Losses experienced in these subgroups.

acres per cow. On comparatively low carrying and producing land, such as that of the Raglan district, it is probably easier to increase stocking than is the case on the heavily-stocked high-producing Waikato plains; but unless per-cow production is increased, a corresponding increase in cows does not result in a relatively high per-acre production increase.

Butterfat-production.

The per-acre production capacity of this land under existing conditions is low, ranging from 74·9 lb. to 15·03 lb. butterfat, with an average of 43·72 lb. It must be remembered that approximately 32 per cent. of the land is not used, and that the butterfat-production standard of cleared land is 64·3 lb. per acre. It is not at present possible to estimate correctly the average per-acre production for the whole of the dairying-land of New Zealand, but if 200 lb. be accepted as the average production per cow, then the per-acre production must be between 50 lb. and 65 lb. This would indicate that the average for the group under review is comparable with that of the mass of farms below the New Zealand average.

Low per-acre carrying-capacity of herds with an average production ranging from 254 lb. to 133 lb. butterfat, with a general average of 193 lb., is a very difficult combination, which can only be rectified slowly while floating capital remains limited. Should carrying-capacity be increased, an additional five cows per 100 acres results in an increase of 9·65 lb. butterfat per acre; whereas with a per-cow production of 291 lb. (average for the Piako group) a corresponding increase of cows improves the per-acre production by 14·55 lb.

FIG. 2. ONE OF THE SMALL CENTRES IN THE DISTRICT.
The prevalence of gorse is shown by this view.
[*Photo by H. Drake.*

Returns per 100 Acres.

The average return from butterfat at 1s. 4d. per pound is £219, or £12 17s. 3d. per cow. Pigs are kept on fourteen of the farms, giving an average return of £1 5s. 3d. per cow. They were disposed of equally as porkers, baconers, or weaners, at the rate of 1·66 pigs per cow. Purchased foodstuff has been debited direct to the Pig Account. The Cattle Account resulted in a loss on five farms, but gave an average profit of £20 10s. per 100 acres over all. This is again accounted for to some extent by the appreciation in value of young stock drafted into the herd, and does not represent all cash.

The total returns thus amount to £345·437, or £15 5s. 4d. per cow, which represents £3 9s. 1d. per acre. The variation is from £6 12s. 2d. to £1 2s. 5d. per acre.

Capital Value.

Owing to the absence of a Land and Improvement Account, the Government valuation has been taken, and to this added the value of stock and plant. Stock values are kept uniform throughout. The position is set out in Table 5.

Table 5.—Capital per 100 Acres (Land at Government Valuation).

	1.	2.		3.		4.	
	Total Capital.	Land.		Stock.		Plant.	
		Value.	Percentage of Total.	Value.	Percentage of Total.	Value.	Percentage of Total.
	£	£		£		£	
Dairy farms ..	1830	1316	71·91	331	18·08	183	10·00
Mixed farms ..	1420	1091	76·83	245	17·25	84	5·91

The total capital of £1,830 is equivalent to £80 17s. 6d. per cow, of which 71·91 per cent. is land, 18·08 per cent. stock, and 10 per cent. plant. The range of capital is from £3,360 to £880 per 100 acres.

Upkeep and Running Expenses.

The cost of upkeep and running expenses amounts to £1 6s. 6d. per acre, or £5 17s. 6d. per cow, and is equivalent to 7·29d. per pound of butterfat. The range is from £2 8s. 2d. to 10s. 7d. per acre, the higher

Table 6.—Expenditure on Dairy Farms per 100 Acres.

(£132·875 = 100 per cent.)

Item.	Percentage of Total.
Fertilizers for top-dressing	44·333
Cartage of butterfat	10·667
County rates	8·333
Depreciation on plant and buildings	8·333
Cultivation	7·167
Repairs to plant, fences, and buildings	7·167
Power (benzine)	6·083
Testing	4·500
Sundry	3·417
Total	100·000

cost being on higher-producing country. Certain items charged on a fixed rate, such as cartage of butterfat, testing, and power, influence the per-acre charge considerably. Of the costs itemized in Table 6, it will be seen that fertilizers for top-dressing pastures is the outstanding expense, representing 44·333 per cent. of the whole. Cartage of butterfat is charged at a fixed rate This item is not paid directly by the farmers, being a deduction made by the dairy company concerned.

Total Expenses.

Total expenses have been computed on the basis of 6 per cent. interest on total capital value plus 1 per cent. sinking fund, and on a labour charge of £7 per cow plus upkeep and running costs. Such a standard is not unduly high, and it should be at least the aim of the dairying industry to breed and feed cows of a calibre able to support it. The expenses on this basis range from £641 to £194 per 100 acres, with an average of £418 17s. 6d., or £18 15s. 5d. per cow.

With wages charged on a per-cow basis, an increase in carrying-capacity influences the total cost considerably. Higher carrying-capacity is also reflected in higher interest charges on capital employed. These farms, however, will not support such a scale of expenses, but result in an average loss of £73 8s. 7d., or £3 5s. per cow. The wage capacity for the year under the present system of management is therefore £3 15s. per cow, interest charges remaining stationary. Three of the farms showed a profit of £45, £29, and £28 respectively, the remainder resulting in a loss varying from £12 to £199, on the basis of £7 per cow for labour.

Production Costs per Pound of Butterfat.

The per-pound cost of producing butterfat on the interest and labour basis fixed (£7 per cow for wages, and 6 per cent. interest plus 1 per cent. sinking fund) varies from 33·3d. to 18·6d., with a general average of 23·2d. The effect of low-producing cows on partially developed land is clearly demonstrated To put these farms on an economic basis an increased production of 48·8 lb. per cow, or 11·01 lb. per acre, is required, provided other items remain the same.

Top-dressing.

The fertilizers used for top-dressing amounted on an average to 9·563 tons, but this was applied to that area actively devoted to dairying only. If the whole of the land were in use and manured proportionately the amount used would have been 14·6 tons. When considering the weight of manure used on dairy farms it is the amount used per cow rather than per acre that is of economic importance, and it is found on low carrying-capacity farms with herd averages comparatively low that the manure cost per cow or per pound butterfat is much higher than is the case on high carrying and producing farms. For the Piako County group reviewed in the August *Journal* 2·33 lb. of manure was used for every pound of butterfat produced, while for the group here under consideration the amount was 4·89 lb., or on a per-cow basis 6·04 cwt., against 8·45 cwt.

FIG. 3. A DAIRY FARM OF THE LOCALITY.

FIG. 4. FARM ON TYPICAL EASY HILL COUNTRY.

[*Photos by H. Drake.*

Analysis of Mixed-farm Figures.

A summary of the position of mixed farms will be found in Table 4, placed contiguously to Table 3 for ease of comparison with dairy farms. The number dealt with is small, but serves to indicate the pros and cons of the two types on similar land. The average area is considerably larger, but dairy-products are the dominant source of income. On these farms only a limited area is used for butterfat-production, cows being wintered on rougher pasture. Herds are comparatively uniform in size, but decrease per 100 acres as the total area increases.

Although there are a number of high-producing herds the general average production of butterfat per cow is below that for dairy farms proper, being 188·94 lb. against 193·26 lb. The range is from 270 lb. to 131 lb. per cow. The per-acre production averages 21 lb. over the ten farms.

Sheep Capacity.

As indicated in Table 1, the sheep-carrying capacity of this country is approximately 1½ mixed sheep per acre. Of those actually carried breeding-ewes predominate, though there is a tendency on some farms to increase dry stock to cope with second growth and fern. A large proportion of lambs are sold fat off crops. The number carried ranges from 133 down to 28 per 100 acres, with an average of 80·1. The heavier sheep-carrying farms are those of larger area, where the influence of dairy cows is proportionately less.

Total Returns per 100 Acres.

The returns per 100 acres range from £311 to £111, with a general average of £232 18s. In this amount cows represent 59·682 per cent., sheep 21·597 per cent., cattle 10·133 per cent., and pigs 8·588 per cent. The average return amounts to £2 6s. 2d. per acre, varying from £3 2s. 2d. to £1 2s. 2d. Outside labour connected with sheep, such as shearing and crutching, has been debited directly to the Sheep Account.

Maintenance and Running Expenses.

In computing maintenance expenses per 100 acres the same principles have been observed as in the dairying group, with the exception of items such as woolpacks and dip, which have been debited to the Sheep Account. Expenses range from £122, or £1 4s. 4¾d. per acre, to £62, or 12s. 4¾d. per acre, with an average of £81, or 16s. 2½d. per acre.

Capital per 100 acres.

It will be seen from Table 5 that the total capital employed (Government valuation of land) is lower than is the case on dairy farms, land having a higher percentage value, while stock and plant are slightly lower. The influence of cows on the price of sheep-land is considerable. The range is from £1,890 to £800, with a general average of £1,420.

Total Expenses per 100 Acres.

Owing to the distribution of labour over both sheep and cows, it is not possible to compute labour capacity on a per-cow basis. Total expenses therefore represent interest on capital at 6 per cent. and 1 per cent. sinking fund, plus maintenance and running expenses.

This item is not comparable with total expenses of dairy farms. The range is from £246 to £136, with an average of £180.

Wage Capacity per 100 Acres.

The wage capacity is considerably lower on mixed farms than on dairy farms, being £51 10s. against £84 11s. 3d. To obtain the same labour reward, therefore, an area of approximately 160 acres is required under mixed farming; in other words, dairying returns 60 per cent. higher labour reward per acre than does mixed farming on this class of country. Of the ten farms two result in a loss, giving no labour surplus whatever. The highest return is £127, and the lowest minus £27.

Manure per 100 Acres.

There is a considerable amount of manure used on these farms, but as it is not applied exclusively to dairying-land it is not possible to state the amount per cow. The range per 100 acres is from 8·2 tons to 2·4 tons, with an average of 5·41. As the average area is 387 acres, it will be seen that the per-farm average is in the vicinity of 21 tons.

FIG. 5. VIEW ON MIXED SHEEP AND DAIRY FARM.
[*Photo by H. Drake.*

True Financial Position.

It must be appreciated that the foregoing analyses do not represent the true position of these farms, owing to a certain amount of personal capital being employed on every holding, and that 7 per cent. is not paid on all borrowed capital. By accepting the Government valuation as a basis it is possible to show the true wage and interest capacity. It is probable that many farms have cost their owners more than the amount represented by the Government valuation, but it is obvious that if this is the case the cost of such land is above its present earning-value.

Table 7.—True Financial Position of Farms per 100 Acres.

Subgroup.	1. Personal Capital.	2. Borrowed Money.	3. Interest paid on Borrowed Money.	4. Maintenance Expenses.	5. Total Returns.	6. Interest and Wage Capacity.	7. Interest on Personal Capital at 7 per Cent.	8. Wage Capacity.
	Dairy Farms. (Four Groups of Four Farms each.)							
	£	£	£	£	£	£	£	£
1	1052·250	1450·250	99·500	188·250	524·750	237·000	73·650	163·350
2	1015·730	861·770	48·470	134·250	377·250	194·530	71·050	123·480
3	808·500	906·500	54·250	116·750	292·500	121·500	56·588	64·912
4	473·500	751·500	39·750	92·250	187·250	55·250	32·975	22·275
General average	837·495	992·505	60·492	132·875	345·437	152·070	58·125	93·945
	Mixed Farms. (Two Groups of Five Farms each.)							
1	567·600	1088·400	67·600	91·200	252·000	93·200	39·230	53·970
2	699·600	484·400	23·600	70·800	213·800	119·400	49·000	70·400
General average	633·600	786·400	45·600	81·000	232·900	106·300	44·115	62·185

Table 7 shows for both classes of farm the amount of personal and borrowed money represented by total capital on the Government valuation basis, giving the averages of subgroups. It will be seen that interest actually paid on borrowed money is low, varying from 5 per cent. to 7 per cent. Column 6 represents the actual money handled by the farmer after interest on borrowed money, maintenance, and running-expenses are paid. Columns 7 and 8 show a division of this amount between interest on personal capital at 7 per cent. and wages. The justice of allowing interest on personal capital will not be disputed, and we therefore have wage capacity only to deal with. The average area of the dairy farms is 173·8 acres, which gives the owner £163 5s. 6d. Mixed farms average 387·1 acres, which allows the owner £240 14s. 3d. Out of these amounts all wages must be paid (shearing and crutching excepted) and the farmer's family maintained.

Table 2 indicates that on the dairy farms permanent hired labour equals 0·144 labour units per 100 acres, which is equivalent to 0·25 per 173·8 acres. The expenses of permanent labour on dairy farms is therefore £29·5 at £1 10s. per week, plus 15s. per week for keep. This reduces the family wage to £134 0s. 6d. The mixed farms employ 0·13 person per 100 acres, or 0·5 per average-size farm of 387·1 acres. On the same wage-and-keep basis this represents £45 10s. per annum, leaving the owner with a family wage of £195 4s. 3d.

Table 8.—Showing "Spread" per 100 Acres in each Factor for Dairy Farms.

Cows milked.	Total Butter-fat.	Butter-fat per Cow.	Returns.				Capital Value of Land, Plant, and Stock.	Expenses.				Profit or Loss (−).	Production Costs per Pound Butter-fat.	Wage Capacity.	Manure per Cow.	Total Manure.
			Butter-fat.	Pigs.	Cattle.	Total.		Interest.	Labour at £7 per Cow.	Upkeep and Running.	Total.					
	lb.	lb.	£	£	£	£	£	£	£	£	£	£	d.	£	Tons.	Tons.
..	7491	..	500	..	..	..	..	..	..	241	..	..	..	..	..	..
..	7304	254	487	..	..	664	..	..	..	220	..	..	..	278	..	16·7
..	5793	220	387	112	88	527	3360	235	..	175	641	..	33·3	187	..	14·0
..	5101	217	340	55	74	463	2480	174	249	148	619	45	31·0	165	0·84	13·5
35·5	4902	211	327	37	65	445	2390	167	232	146	610	29	28·8	153	0·64	12·2
33·2	4796	209	320	36	42	407	2160	151	232	146	525	28	28·8	136	0·56	12·2
33·1	4703	205	313	35	31	385	2100	147	229	143	477	− 12	28·7	104	0·51	11·4
32·7	4495	205	300	29	25	363	2010	141	173	139	456	− 48	23·8	91	0·50	10·9
24·7	4408	200	293	29	21	354	1850	130	158	134	446	− 72	23·8	88	0·48	10·8
Average																
22·7	4372·5	193	291	28·563	20·5	345·437	1830	128	158	132·875	418·875	− 73·438	23·2	84·562	0·425	9·563
22·6	3800	188	253	27	12	329	1800	126	155	115	383	− 76	22·8	83	0·40	8·7
22·5	3797	187	253	21	10	290	1750	123	151	111	379	− 80	21·7	67	0·39	8·4
22·1	3796	182	253	20	9	289	1740	122	142	107	377	− 82	21·4	64	0·37	8·4
21·5	3102	175	207	19	8	262	1670	117	135	102	372	− 83	20·6	62	0·37	8·0
20·3	2891	168	193	17	− 2	243	1640	115	133	79	361	− 92	20·5	− 2	0·36	6·9
19·3	2081	156	140	13	−12	233	1170	82	116	67	338	−114	20·3	− 7	0·35	4·8
19·0	1503	153	100	11	−12	161	1150	81	99	53	291	−130	20·3	−34	0·34	3·8
16·5	..	133	..	Nil	−19	112	1130	79	95	..	245	−147	19·4	−82	0·32	2·3
14·1	..	..	..	Nil	−50	..	880	62	79	..	194	−166	18·6	..	0·20	..
13·6	..	..	..	..	..	..	..	..	..	..	..	−199	..	..	0·18	..
11·3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

Table 9.—Showing "Spread" per 100 Acres in each Factor for Mixed Farms.

Cows milked.	Sheep wintered.	Total Butterfat.	Butterfat per Cow.	Returns from					Capital Value of Land, Plant, and Stock.	Expenses.			Wage Capacity.	Manure used.
				Butterfat.	Pigs.	Cattle.	Sheep.	Total.		Interest.	Upkeep and Running.	Total.		
..	..	lb. 3201·0	lb. ..	£ 213	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	Tons. ..
..	..	2904·5	..	193	..	..	..	..	..	..	..	..	..	..
18·4	..	2510·2	270	167	..	..	..	311	..	..	..	..	..	..
16·3	133	2502·4	267	167	54	..	102	295	..	..	..	246	127	8·2
15·8	129	2401·6	244	160	37	89	98	268	1890	132	122	212	112	8·1
15·7	125	2310 0	231	153	30	57	55	253	1880	132	115	203	99	6·3
12·0	105	2106·0	200	140	21	37	53	248	1870	131	82	201	67	5·6
Average 11·08	80·1	2093·56	188·949	139	20	21·7	50·3	232·9	1420	99	81	180·0	51·5	5·5
10·0	63	1390·8	185	90	16	20	45	220	1390	97	78	173	50	5·41
7·8	61	1200·0	154	80	13	20	44	213	1360	95	71	169	45	5·3
6·0	56	406·1	152	27	12	12	40	208	1280	90	71	168	44	4·3
5·7	54	..	136	..	11	1	27	202	1260	88	70	157	25	4·2
3·1	47	..	131	..	6	1	23	111	1050	74	70	138	—27	4·2
..	28	..	..	..	Nil	9	16	..	800	56	69	136	—27	2·4
..	..	..	..	..	..	9	..	..	..	..	62	..	..	..

It must also be remembered that a certain amount of outside casual labour is employed for harvesting and improvement work, which must be paid out of these surpluses.

If we return for comparison purposes to the original basis of 6 per cent. interest plus 1 per cent. sinking fund on capital value of land, stock, and plant, the dairy farms earn interest at the rate of £5 13s. per cow, or £1 5s. 7d. per acre; maintenance, £5 17s. 5d. per cow, or £1 6s. 5d. per acre; and wages, £3 14s. 7d. per cow, or 16s. 11d. per acre. Mixed farms earn interest at the rate of 19s. 10d. per acre; maintenance 16s. 2d., and wages 10s. 7d., per acre.

If it is agreed that £7 per cow is not an unduly high wage allowance, then on land of this nature and under the system of cow-management practised the total capital valuation should not exceed £779 12s. per 100 acres, of which the major portion is represented by stock and plant. The most profitable farm of the group earns interest at the rate of 7 per cent. on a capitalization of £3,000, or £30 per acre, after allowing £7 per cow for wages; but at the other extreme are farms earning no interest and very small wages.

FIG. 6. TOP-DRESSING GRASSLAND.

[*Photo by H. Drake.*

Conclusion.

Tables 8 and 9 give the spread of different items across the average for the dairy and mixed farms respectively. Each farmer's figures will be marked and forwarded for his information, as explained on pages 87 and 88 of the August *Journal*.

The survey has shown that the dairy farms have a considerably higher per-acre earning-capacity than have mixed farms; but with larger areas under mixed stocking conditions the total wage capacity is larger, thus allowing more margin for living-expenses. Land will be more quickly brought into a state of high production under dairying conditions on comparatively small holdings, mainly through hard work. The improvement in production of the last few years indicates that in time the present owners will be rewarded if able to hold on and increase their carrying-capacity with cows of higher-production strains.

The field-work of the survey was again carried out by Mr. I. W. Weston, M.Sc., of the Fields Division.

CONTROL OF BROWN-ROT IN STONE-FRUITS.

EXPERIMENTS WITH PEACH-TREES AT HENDERSON, 1926–27 SEASON.

Horticulture Division.

THE experiments in the control of brown-rot fungus (*Sclerotinia cinerea*) carried out by Mr. W. H. Rice, Orchard Instructor, Auckland, in co-operation with Dr. R. H. Makgill, in his orchard at Henderson during the season of 1925–26 were continued during 1926–27. The 1925–26 experiments (reported in the *Journal* for September, 1926) had again indicated the superiority of bordeaux dormant sprays for stone-fruit trees—not so much for the control of the fungus as for general reasons. Therefore all experiment sections during the season now under review were given that spray treatment when the trees were dormant and the buds commenced to break. The superior results of atomic-sulphur summer sprays during the 1925–26 season led to them being followed up by trials of different forms of atomized sulphur as a control when the trees were in leaf. They were Sulpho, atomic sulphur, and dry-mix sulphur. Sulpho is a dry-powder form of atomized sulphur. Dry-mix sulphur is a variation in the compounding of the well-known self-boiled lime-sulphur, and is made as follows :—

Soda stock solution (1 lb. caustic soda in 1 gallon water).

½ lb. casein (bring to the consistency of milk by adding 1 gallon water and ¼ pint soda solution, and stirring well).

16 lb. fine powdered sulphur (sift the sulphur and thoroughly wet it by adding the dissolved casein and as much more water as is necessary to bring it to the consistency of cream).

5 lb. fresh rock-lime (slake the lime carefully ; dilute the milk up to 10 gallons ; place it in the spray-tank, start the agitator, add the " creamed " sulphur, and then water to make it up to 100 gallons).

The relative freedom from brown-rot of the check trees in the present experiment may be attributed to the large amount of free sulphur in the orchard, which was so pronounced as to be detectable some distance away ; also, no doubt, to the general cleanliness of the orchard. All dead wood, prunings, and mummified fruits were gathered and destroyed, and infected fruit was gathered at short intervals during the season. It is therefore more to orchards in the locality that one must look for comparisons ; the loss of fruit from the ripe-rot form of this disease in such orchards is estimated at 25 to 40 per cent., according to the amount of spraying done and the class of sprays applied.

During the winter of 1926 the trees on the area were methodically pruned. Special attention was given to the removal of all dead or diseased wood, also of mummified fruits. All prunings, &c., were carefully collected and removed from the area and burned. The land was ploughed, with the exception of the strips between the trees, prior to bud-movement.

DORMANT-PERIOD SPRAYS.

At bud-movement all trees except Paragon were sprayed with bordeaux, 5–4–50. Paragon, owing to its extra susceptibility to leaf-curl in this district, received bordeaux, 8–6–40, and all the trees were

sprayed with oil, 1–17, the following day. The area had been divided for treatment into three sections as follows :—

Table 1.

Varieties.	Section 1.	Section 2.	Section 3.	Total Trees.
Paragon	52	76	59	187
Carmen	19	24	32	75
J. H. Hale	9	3	0	12
Hay's Cling	7	7	9	23
Golden Queen	9	16	17	42
A1	0	0	9	9

SUMMER SPRAYS.

Later sprays applied to each block are shown in the following table :—

Table 2.

Stage of Growth.	Section 1.	Section 2.	Section 3.
Pink, full pink, and petal-fall	Sulpho, 10 lb. to 100 gallons ; all varieties	Atomic sulphur, 10 lb. to 100 gallons	Dry-mix sulphur (16 lb. sulphur, 5 lb. lime, 8 oz. casein, 100 gallons).
Fruit-setting	Ditto	Ditto	Ditto.
Three weeks later ..	Ditto	Ditto	Ditto.
Three weeks later ..	Ditto	Ditto	Ditto.
Prior to ripening ..	Same spray—Carmen only	Ditto ; Carmen only	Ditto ; Carmen only.
Ripening	Same spray—all varieties except Carmen	Ditto ; all varieties except Carmen	Ditto ; all varieties except Carmen.

A cross-block consisting of 15 Paragon, 10 Carmen, 11 Golden Queen, and 6 Hay's Cling was left unsprayed after 18th October as a check for ripe-rot. This gave a test of Sulpho *versus* atomic sulphur *versus* dry-mix sulphur, each on an initial spray of bordeaux.

CONTROL OF SPRING INFECTION.

Spring forms of brown-rot infection showing were bud-rot, twig-rot, and blossom-rot. These forms showed practically the same degree of susceptibility of tree variety as prevailed under the test carried out the previous season, and the matter is apparently largely one of varietal resistance. Paragon was outstanding in this respect. The following observations were made :—

Carmen : Bud-rot and blossom-rot very bad ; twig-rot bad. Loss equal to 98 per cent. of crop as indicated by bud-development.

Golden Queen : Bud-rot medium ; twig-rot bad. Loss of crop, as indicated by bud-development, considerably less than previous season, a medium setting of fruit showing.

J. H. Hale : Twig-rot prevalent. These trees had only a medium blossoming, which set erratically. Bud-rot showing on Section 2 only.

Hay's Cling: Twig-rot and bud-rot light. Fair setting of fruit.

Paragon: No bud-rot or blossom-rot. Good setting in all sections.

None of the sprays applied gave thorough control of spring infections of brown-rot, excepting on Paragon.

CONTROL OF SUMMER INFECTION ("RIPE-ROT").

Comparative fruit-infection on the three sections was as follows:—

Table 3.

Section.	Spray.	Check Trees.	Summer-sprayed Trees.
1	Sulpho	10 per cent.	7 per cent.
2	Atomic sulphur	10 per cent.	10 per cent.
3	Dry-mix sulphur	8 per cent.	5 per cent.

In Section 1 the effect of Sulpho was certainly beneficial, this being specially so on some trees which had been consistently bad for ripe-rot. Atomic sulphur was not as effective as anticipated, and showed the highest percentage of ripe-rot of the three sulphurs tried. Dry-mix sulphur proved the most effective on all varieties. The growth and foliage on the whole of this plot were far above normal years, which seems to show that, besides checking brown-rot, sulphur in a finely divided form has a very beneficial effect on the trees generally.

The season was a very wet one, with muggy conditions prevailing during the ripening-period, and brown-rot was very prevalent throughout the whole district—in a measure far in excess of that indicated by the check trees. As already stated, these were probably influenced by the abundant free sulphur present in the orchard, and the value of some form of sulphur spray during the summer was well demonstrated.

SUMMARY.

Bordeaux as a delayed dormant spray is the most satisfactory base. Bud-rot, blossom-rot, and twig-rot on all varieties except Paragon were not fully controlled by any of the sprays used. Degree of infection was largely a matter of susceptibility of variety, Paragon being outstanding in that respect.

Sulpho, 10 lb. to 100 gallons of water, gave reasonably satisfactory control of summer fruit-rot.

Atomic sulphur, 10 lb. to 100 gallons, although giving fair control, showed the highest percentage of summer rot of the three sulphurs tried.

Dry-mix sulphur gave the best control, the percentage of summer fruit-rot being less than with either of the other two treatments; moreover, the growth and foliage were outstanding in quality and general healthy appearance.

PUWERA GUM-LAND EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1926–27.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

DAIRYING.

THE season of 1926-27 completed the second year of dairying at the Puwera Experimental Farm. The herd consisted of six heifers, nine second calvers, and six mature cows—all grade Jerseys of good type. The herd was again tested, and the average return of the twenty-one head was 282·8 lb. butterfat. The average period in milk per beast was 263 days. This represents an average improvement of 62·8 lb. of butterfat per head on the preceding season's return. The highest individual yield was 369·1 lb., and the lowest 209·7 lb. Most of the cows calved in August and September, but two calved in July, while four heifers came in after September, and one was as late as November. We have been able to maintain the stock-carrying capacity of the land at a cow to 2 acres.

The season proved a favourable one for pastures. Copious rains throughout the milking season sustained succulent and adequate herbage, and supplementary feeding, though resorted to, was almost unnecessary. The writer is of the opinion, however, that recourse to supplementary feeding proved beneficial. Cows appreciate a change of feed, even when pastures are luscious and growing well right through the season. At Puwera we have English grass pastures with a good proportion of clovers present ; there are also paspalum-clover pastures and areas of kikuyu-grass. In addition to the changes supplied by these pastures, Japanese millet, soft turnips, maize, and grass silage were fed. It is claimed that such varied feed induces the stock to eat more, and that, therefore, they maintain a better flow of milk. Even when a season proves entirely favourable for pastures, supplementary crops and fodders are thus worth while.

Hay, mangolds, and swedes were fed out on the farm in the winter months.

WATER-SUPPLY.

Owing to regular rains, water-supply was adequate during the year. A bore was put down on the ridge in Field 5 to a depth of 300 ft. For the first 18 ft. the bore went through white pipeclay, and from that depth onward to 300 ft. through hydraulic limestone, probably a continuation of the Portland beds. Failing to make a good strike of water, the bore was abandoned after a depth of 300 ft. had been reached, and a dam, fed by springs, was made in Field 4. There are 11,000 gallons of good water impounded in the dam. The dairy shed and troughs are supplied from this reservoir by means of pipes, the water flowing by gravitation. The dam was merely dug out of the clay, which holds the water quite well.

EXTENSION OF DAIRY FARM.

Up to the time of writing this year 41 acres of pasture have been added to the dairying area, making a total of approximately 100 acres

of improved land. This will allow of about 40 cows being carried in the present season, and with other stock, including a bull, calves, yearlings, pigs, and three horses, the equivalent of a dairy cow to 2 acres will still be maintained. The shed has been altered and a three-cow milking-machine installed.

The new grass areas which were broken in from the virgin gum-land, using cultivation methods described in the *Journal* for November, 1926, are looking well and promise to make good permanent pastures. A portion of the cost incurred with previous breaking-in methods—by extra cultivation and a long fallow in addition to a preliminary dressing of lime—has been put into extra phosphatic manure, and the results so far seem to indicate that the latter, which is cheaper, is more profitable. This consideration is an important one, because it promises to reduce the cost of the breaking-in process, a matter of some consequence to a settler improving gum-land and having only a limited capital at his disposal.

EXPERIENCE WITH FERTILIZERS.

Pastures on the farm as a rule are treated each year with 2 cwt. to 3 cwt. of basic slag, or in some cases with basic super. The upper portion of Field 6, $2\frac{3}{4}$ acres in extent, was again cut for hay. This area consists chiefly of paspalum, Lotus major, and white clover, with a sprinkling of rye-grass. Before being closed in the spring it was dressed with fish fertilizer (analysis—nitrogen 7·6 per cent., tricalcic phosphate 28·1 per cent.) at the rate of 1 cwt. per acre. The response was very satisfactory, and, since lack of nitrogen is a definite limiting factor on the white pipeclay soils, one is not surprised. About 7 tons of hay were cut from the area (Fig. 2). The fish fertilizer was supplied by Sandford Ltd., of Auckland. Our results with crops also were equally good where this vehicle for nitrogen was used. In fact, the results have been so promising that it is intended to include fish fertilizer in our systematic field experiments where nitrogen has been ordinarily used in the form of blood, sulphate of ammonia, or nitrate of soda.

Seychelles Island guano was used as a preliminary dressing on soil prepared for sowing to permanent pasture. It was applied at the rate of 9 cwt. per acre on Field 9 a few weeks before sowing the grass-seed. Side by side was an area on which 9 cwt. per acre of basic slag was applied on the same day as the guano. Three hundredweight per acre of super was applied with the grass-seed, which was sown in the middle of April last. The take of grass was satisfactory, but the plots which received the extra phosphate in the form of Seychelles guano and basic slag respectively presented a striking contrast to the check plot, which only received the 3 cwt. of super with the seed. The point is an interesting one. The response to phosphate is very marked. Why not increase the dressing on soils where the fertility is naturally much below the average? If one can get a good sward of grass quickly by using from 10 cwt. to as much as 13 cwt. of phosphate per acre, it is highly probable that the generous treatment will pay. The good pasture produced will carry stock, and thus give quick returns of marketable products, this in turn allowing the farmer to continue generous treatment of the land. In the case of gum-land of the Puwera type this seems to be the best course.

FIG. 1. GENERAL VIEW OF THE FARM FROM FIELD 5.

Dairy shed and yards in centre middle distance; overseer's house on extreme left. New grass area across creek in distance. Photo taken on occasion of visit of Auckland Agricultural Science Club.

FIG. 2. HAY CUT FROM 2¾ ACRES IN FIELD 6.

The pasture was top-dressed with fish fertilizer before being closed.

GUM-LAND PROSPECTS.

As already mentioned, the average return per cow last season was 282 lb. of butterfat. When the dairy herd reaches a more mature stage the average should be well over 300 lb. The pastures at Puwera show steady improvement each year; hay can be made and silage conserved without difficulty; special crops to supplement the pasture can be easily grown, and all stock do well on the area. These facts, together with the satisfactory returns from dairying, demonstrate that when the time does arrive for greater utilization of these gum-land areas the soils will respond well to reasonable treatment. They now represent, thanks largely to the excellent climatic advantages of North Auckland, a very large area of potential dairying and general-farming land still unoccupied, only needing capital and the proper treatment to bring it into profit. The good result secured at Hautu and Rangipo, in the central pumice areas, by the use of prison labour suggests a practicable means of improving gum-land for settlement on a similar scale.

NAURU AND OCEAN ISLANDS PHOSPHATE INDUSTRY.

SHIPMENTS of phosphate from Nauru and Ocean Islands for the year ended 30th June last—the seventh under the control of the British Phosphate Commission—were approximately 593,300 tons, as compared with the previous highest output of 470,700 tons in 1924–25, an increase of about 122,600 tons. This result was owing mainly to unusually favourable weather throughout and satisfactory labour and health conditions. During 1925–26, when adverse weather and labour conditions were experienced, shipments were only 391,700 tons.

Deliveries of Nauru-Ocean phosphate to New Zealand for 1926–27 were approximately 135,200 tons, as compared with 77,400 tons for the previous corresponding period. These quantities, however, were insufficient to meet the rapidly increasing demand, and the Commissioners purchased on behalf of the fertilizer manufacturers considerable quantities of phosphate from outside sources at the lowest prices obtainable, though at a considerable increase on Nauru-Ocean rates. This outside phosphate is of lower quality, but by judiciously mixing it with the relatively large supply of high grade the manufacturers have been able to maintain the high standard of phosphatic fertilizers obtaining in this market.

With the object of increasing the output from both islands an extensive programme of development has been decided on, starting with an improvement of the shipping facilities. Contracts were signed in March last with Messrs. Henry Simon, Ltd., of Manchester, for the construction of a loading cantilever at Nauru and an improved steel jetty at Ocean Island. This work will probably extend over two years, entailing an expenditure of about £250,000, which will be financed by the Commission.

The cantilever for Nauru embodies some unique features suited for the special conditions pertaining there. It will project about 180 ft. beyond the edge of the reef, and will permit of discharging the phosphate direct into the vessel's fore and after holds simultaneously, thus dispensing with the present system of loading by means of small lighters. The material will be transferred from the 12,000-ton shore storage bin to the discharging-points of the cantilever by rubber-belt conveyers with a total capacity of 600 tons per hour, thus enabling the loading of a 6,000-ton vessel in a day. The outer arms of the cantilever will operate on the principle of a wharf-crane, permitting them to swing in on the reef when not in use. The whole plant will be operated electrically. It is hoped that on completion of the cantilever installation the annual output capacity will be increased to between 700,000 and 770,000 tons.

Other improvements facilitating production and transport are also to be put in hand at both islands, with a view to getting the best possible service from the improved shipping arrangements.

MONAVALE QUEEN BESS.

SIXTH C.O.R. 1,000-lb.-BUTTERFAT COW.

Dairy Division.

THE name of the Friesian cow Monavale Queen Bess needs no introduction to *Journal* readers interested in the performance of our pure-bred dairy cattle. In September, 1921, she completed a certificate-of-record test on which she gained a certificate for 740·50 lb. butterfat from 20,501·1 lb. milk. This yield, made at the commencing age of 2 years 16 days, placed her at the head of the junior two-year-old Friesians, and the record still stands as the highest for that class.

MONAVALE QUEEN BESS (T. H. RICHARDS, CARDIFF).
C.O.R., 1927, in Friesian mature class: 26,461·8 lb. milk, 1,002·20 lb. butterfat.

The following year, commencing at the age of 3 years 56 days, she concluded test with 21,609·3 lb. milk containing 800·18 lb. butterfat, which remains the junior three-year-old class-leadership record. A third certificate was gained in 1924 25, her production then reaching the further advanced figure of 950·90 lb. butterfat from 25,598·0 lb. milk in 333 days. On that occasion illness curtailed her testing-period.

By calving subsequent to test on the 11th of last month, Monavale Queen Bess completed a test which entitled her to the coveted distinction of a 1,000 lb. record. Commencing test at the age of 7 years 363 days, she produced in the ensuing 365 days 26,461·8 lb. milk containing 1,002·20 lb. butterfat. Her four certificates of record thus

represent an average butterfat-yield of 873 lb.— the highest performance of its kind for New Zealand. For the record just completed the period between calving for commencement of test and calving subsequent to test was 410 days. Her calving for commencement of test was 332 days later than the preceding calving, which means that she has had three calvings within two years and some twelve days.

Monavale Queen Bess was milked three times daily during the whole of her lactation period. As our breeders know, the New Zealand C.O.R. rules restrict the number of daily milkings for test cows to three. In other countries, particularly the United States of America, high-producing cows under test are usually milked four times daily, while there are several instances of record-breaking animals being milked even six times daily during their flush period. New Zealand test cows are therefore handicapped to a certain extent when competing with foreign champions.

While, however, it is very gratifying that New Zealand possesses dairy cows which are capable of ranking high among the world's leaders, we are of the opinion that a general high standard of production is of more benefit to the country than a few record-breakers. Our C.O.R. rules were designed with special attention to ordinary herd conditions, hence the stringent calving qualifications and the restriction to not more than three-times-a-day milking. Had it not been that after a cow produces more than a certain quantity of milk mere humaneness demands thrice-daily milking, it is possible that the C.O.R. rules might not have permitted more than twice-a-day milking. The fact that we have cows which under these severe test conditions can attain to such creditable standards of production adds to the merit of Monavale Queen Bess and those other animals with which she ranks.

Monavale Queen Bess is the sixth cow to yield more than 1,000 lb. of butterfat under our New Zealand rules for first-class certificates of record. The list, comprising three Friesians and three Jerseys, together with particulars of performance, is as follows:—

Name of Cow.	Breed.	Yield.			Age at Start of Test.
		Days.	Milk.	Butterfat.	
			lb.	lb.	Yrs. days.
Alcartra Clothilde Pietje	Friesian ..	365	31,312·5	1,145·24	7 357
Holly Oak's Annie ..	Jersey ..	365	18,522·7	1,056·49	5 9
Hilda Minto de Kol ..	Friesian ..	365	27,773·8	1,046·31	12 56
Vivandiere	Jersey ..	365	17,282·1	1,036·09	6 10
Pretty's Flirt ..	Jersey ..	365	16,684·1	1,010·49	6 353
Monavale Queen Bess ..	Friesian ..	365	26,461·8	1,002·20	7 363

A conspicuous feature of Monavale Queen Bess's production figures during the last season under test was her extremely uniform yield month by month for the greater portion of the period. It was the uniformly high standard of production rather than an abnormally high production in any individual month or months which resulted in the fine aggregate yield for the year. For the first six full months of her test she was credited with over 100 lb. butterfat per month,

while her heaviest yielding month—October, 1926—credited her with 115 lb. In other words, for six calendar months the extreme variation in monthly butterfat-production was only 15 lb. For the final four months of her test the yield declined rapidly, mainly due to indisposition. Had her good health continued to the conclusion of the test it is probable that her season's butterfat aggregate would have been appreciably higher.

Monavale Queen Bess was born on 31st July, 1918, at "Monavale," near Cambridge, Waikato, and was bred by Mr. C. C. Buckland, whose stud produced many outstanding foundation animals of the breed in New Zealand. It was at Mr. Buckland's dispersal sale that Monavale Queen Bess was purchased as a yearling heifer by her present owner, Mr. T. H. Richards, of Cardiff, in whose ownership she has since remained. Thus Mr. Richards has piloted her through the four highly successful C.O.R. testing-periods.

The pedigree of Monavale Queen Bess has been referred to in detail on two previous occasions in the *Journal*, but for those readers not conversant with the facts it may be repeated that she is by King Laddie from Netherton Pontiac Princess. In addition to Monavale Queen Bess, King Laddie has sired seven other C.O.R. cows. Netherton Pontiac Princess was not tested under the C.O.R. system, but there is evidence of her quality. In appearance she is every inch a producer. Through Woodcrest Pietje Pontiac—sire of eleven C.O.R. daughters, two of which have certificates for over 800 lb. butterfat—and Netherland Princess 4th, who, with 805·77 lb. butterfat, has been leader of the senior two-year-old Friesians since 1914, Netherton Pontiac Princess goes back to Paul Pietertje, King Segis Pontiac, and other individuals which helped to make history for the breed. Through her sire, King Laddie, Monavale Queen Bess traces to an equally distinguished line of ancestors, some of the better-known being Sir de Kol Inka Pietertje, Manor Beets Daughter 2nd of Ashlynn, and Cliffside Laddie.

Even from these brief notes it will be apparent to students of the Friesian breed that the combination of such ancestry might be expected sooner or later to concentrate exceptional productive ability in some individual such as Monavale Queen Bess. The accompanying photograph will serve to show that she looks the part.

Rabbit Control.—In his annual report for 1926–27 the Director-General of Agriculture remarks as follows: "A great improvement has taken place in the position throughout the Dominion as regards rabbits, these being less in number and better under control than has been the case for many years past. Rabbit Boards, where established, have done very good work, and, so far as their districts are concerned, are to be congratulated upon the results attained. Those officers of the Department responsible for carrying out the provisions of the Rabbit Nuisance Act may also be commended, as the present good position must be held to be largely due to their efforts over a period of years of onerous and often unpleasant work. A much greater spirit of united effort between farmers and Inspectors is noticeable, and this is very satisfactory from all points of view."

THE BLACKBERRY PEST.

(Continued from June issue.)

II. DISTRIBUTION.

E. F. NORTHCROFT, M.Sc., Biological Laboratory, Wellington.

WITH a plant so remarkably resistant and strong-growing, and one possessing such adequate and sure means of reproduction by seed, and propagation by means of its rooting-stems, runners, and cuttings, there is little wonder that under New Zealand conditions blackberry has invaded such extensive tracts of land. Its spread can be amazingly rapid; places a few years ago with perhaps only a single apparently struggling plant are now a dense mass of tall impenetrable bushes.

The species *Rubus fruticosus* Linn. is a common plant in Europe—its natural home—being especially abundant in hedges, thickets, woods, along streams, and on all waste lands. It occurs over nearly the whole of Europe (including Russia) and Central Asia, and is also found in northern Africa; but nowhere does it extend to the high altitudes. In Britain it is specially abundant; but nowhere in these countries does it appear to have become a menace or to have given any cause for alarm by its rapid method of spread. There appear to be numerous varieties of *R. fruticosus*. Babington distinguishes forty-five, while Rogers claims to have divided the group into fourteen subgroups comprising over 120 varieties. According to Cheeseman there have been introduced into New Zealand the following subspecies: *R. discolor* Weihe and Nees, *R. leucostachys* Smith, *R. rusticanus* Weihe, *R. macrophyllus* Weihe, and *R. laciniatus* Willd. the two most distinct forms being *Rubus fruticosus*, the common bramble or blackberry, and *R. laciniatus*. In mentioning the blackberry, Cheeseman says, "Copiously naturalized throughout, and probably the most troublesome weed in New Zealand."

Blackberry has been introduced into South Africa, being quite common in some places, especially about Lion and Table Mountains, and also near Klapmuts. In Queensland the plant has also become established, having been brought from Europe, and is now regarded as a noxious weed; but nowhere is it so abundant or troublesome as in New Zealand.

INCIDENCE OF THE PEST IN NEW ZEALAND.

Every county in the North Island and South Island has its blackberry-bushes; but the weed is not so abundant as perhaps commonly supposed. It is certainly seen along some of the railway-lines, occasionally in considerable abundance, and close to some of the railway-stations, especially in the far North. But if one were to travel by train from Wellington to Napier, or from Christchurch to Dunedin, one could count the blackberry-bushes with ease, and this affords a very good indication of the degree of occurrence of the weed on the surrounding holdings. Along river-banks the weed is more common, and is almost always found in places frequented by campers and picnic parties. It is on the waste lands that the really dense areas are to be found—

areas which if cleared would not be suitable for farming. On the better country it is found mainly on blocks held by Natives and on the land not properly farmed. Though one frequently speaks of "blackberry-infested" land, this does not necessarily mean that all the area has a dense covering of the weed. If all the farmable land in New Zealand rendered entirely useless by the presence of blackberry were surveyed, it would not amount to a very great number of acres compared with the aggregate area of this class.

Blackberry is able to flourish on land both flat and hilly, good and poor, but it is seldom that the plant is found on the first-class land or on small holdings — a fact which seems to be significant. In competition with other plants the established blackberry shows itself to be by far the stronger. In some places the weed has managed to secure a footing in reserves of native bush, and here it is seen that the plant, though it has only weak flexible stems, which unaided it cannot hold upright, is able (in the presence of a support) to reach the tops of the supporting vegetation in quite a short time, in its anxiety to expose its leaves to light and air.

As already indicated, it frequently occurs that blackberry is thicker, and the affected areas are greater, where the largest blocks of land are held. Where the holdings are small, though they may be infested, the land is not rendered unproductive, as the weed is kept under control. But although the large blocks present an admitted problem in regard to yearly clearing, it must be pointed out that it is from such infested areas, where the plant is allowed to flower and fruit freely, that seed is carried by birds and left to germinate and so infest clean land many miles away. Though the germinating-power of the seed, even after it has passed through birds, is small, yet it is not necessary for a bird to carry many viable seeds before the pest has been introduced into a hitherto clean locality. Supposing, for example, the commencement is with one seed, which germinates and grows for three years before it flowers and fruits. If from the numerous seeds produced only twenty-five from each plant grow, then at the end of twelve years the descendants of the one original plant would number no less than 107,101. Fortunately, they do not all survive.

PRINCIPAL AFFECTED DISTRICTS.

The districts most seriously affected by blackberry are probably the west coast of the South Island, Taranaki, and northern Hawke's Bay, where the plant flourishes with extraordinary vigour.

It is in Westland that the largest and strongest-growing bushes are to be found; but probably much of the infested land, were it cleared, would be of little or no use for farming. In this district blackberry is specially prevalent round old deserted townships or mining camps, where the plant can be seen smothering the tallest trees of old orchards.

In northern Hawke's Bay the part most severely affected is Wairoa County, where there are several thousand acres of more or less infested land. Among notably badly infested areas in the district are those at Tangoio, Mohaka, Te Ringa, Mahia, and Opoutama. Fig. 20 is a map of part of the county, on which have been shaded in some of the largest infested areas. These are necessarily only very approximate, as

FIG. 20. MAP OF PART OF WAIROA COUNTY, SHOWING PRINCIPAL BLACKBERRY-INFESTED AREAS (SHADED).

it was not possible to make any very exact survey, but they represent areas of scattered blackberry as well as those which are more or less densely covered. The map will at least serve to indicate the position generally, and to give some idea of the relative proportion of clean and infested land.

III. CONTROL.

It is when there are only scattered plants of blackberry in a district that the work of destruction should and could be carried out. Expensive methods can be applied to small scattered areas, while it would be out of the question to use anything but cheap methods of eradication, or, failing that, partial control, on the badly infested areas.

In the destruction or control of any weed pest it is in the outlying areas that the first attack should be made. Each weed will have some

FIG. 21. DENSE MASS OF BLACKBERRY ON FLAT LAND NEAR WAIROA.
Individual bushes in this mass are some 7 ft. high.
[*Photo by E. F. Northcroft.*

centre of distribution at which it is most dense ; it is from this centre that the plant will spread in every direction, and the farther one moves away from the centre the more scattered the plants become. It is at the circumference that methods of treatment should be applied, and from it one should work gradually towards the centre, where the main mass can eventually be attacked. Unfortunately, the usual method in this country is not to trouble about the circumference of spread, but to rush in and perhaps spend years attacking the dense centre, where little or no good is done. In the meantime the then circumference has become badly infested, and the range of infestation has been gradually extended farther and farther from the original centre, the rate of increase becoming more rapid as time elapses.

ESTABLISHMENT OF EXPERIMENTAL STATION.

After carefully considering the problem of control the Department of Agriculture decided to establish a special blackberry experimental station in Wairoa County. In June, 1925, mainly for the purpose of testing the effect of chemical compounds, an area of 40 acres of dense hillside blackberry, which had been left untreated for several years, was secured. This land is situated on the Te Uhi Block, four miles from the Town of Wairoa, along the Gisborne Road. A shed was erected for storing tools and chemicals immediately on securing the lease, and a tank installed, a spring a few chains up at the head of the valley, giving a small but constant supply of water, being tapped.

LINES OF INVESTIGATION.

In a research of this nature there are several main lines of investigation open. In the present case these are: (1) Chemical; (2) biological—(*a*) fungus parasites, (*b*) insect parasites; (3) ecological.

Under the first heading—chemical investigation—it is necessary to ascertain what chemical compounds and combinations of these compounds used as solids, liquids, or gases affect the plant, at the same time determining their relative effect.

By biological investigation is meant the testing of parasites, both fungus and insect, used separately or in combination with each other. Consequently tests are necessary to determine, firstly, what parasites attack the plant, and, secondly, the extent of the damage. If no single parasite seems to have any marked permanent effect, then a combination of parasites should be tried—for instance, one which destroys the young shoots or flower-heads with another which acts as a borer in the crown, and so on.

Ecological investigation is, very broadly speaking, a study of the relation between blackberry and other plants, the effect of such plants, conditions of growth, soil, climate, &c.

Failing any successful method of complete eradication, then the way lies open to investigate methods of more partial control. Under this category must be considered experiments in (1) farm-management by means of (*a*) manurial top-dressing, (*b*) cropping, (*c*) use of live-stock; and (2) afforestation.

(To be continued.)

Pasteurization in Cheesemaking.—Last season the quantity of cheese made with pasteurized milk in the Dominion equalled some 80 per cent. of the total output, as against 76 per cent. in 1925–26.

Animal-breeding.—The chief British centres for research in animal-breeding are to be found at Edinburgh and Cambridge Universities. A grant has recently been made out of the Empire Marketing Fund towards the cost of establishing a Chair of Genetics at Edinburgh University and the development of the Animal Breeding Department. Financial assistance has also been given by the Empire Marketing Board towards work on the reproduction and growth of animals carried on under the Faculty of Agriculture at Cambridge University.

WHEAT-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926–27.

(Concluded.)

A. W. HUDSON, B.Sc., B.Ag., Instructor in Agriculture Christchurch.

Experiment 4 : Farm of R. T. McMillan, Irwell.

IN the seasons of 1923–24 and 1924–25 experiments similar to those being conducted elsewhere during those periods were carried out on Mr. McMillan's farm. The results (see *Journal*, April, 1925, pages 231 and 234) showed nothing significant from the use of phosphatic manures. This somewhat anomalous lack of response to the fertilizers cited indicates (1) that there is an ample supply of phosphate present in the soil, or (2) that some other factor is limiting the effects of the applied phosphates. The results of analyses made at the Department's Chemical Laboratory show a high amount of available phosphate (0·056 per cent. and 0·058 per cent. of citric soluble P_2O_5 from two different fields). This would indicate that the first hypothesis may be fairly correct, although equally high percentages of available P_2O_5 were shown on other areas known to respond quite markedly to the application of phosphatic manures. The lime-requirement shown by the analyses for the two fields in question was approximately 3·1 and 2·3 tons per acre respectively. Apparently, then, lime was deficient.

In the season of 1926–27 an experiment as described below was carried out with the object of determining what factor, if any, other than that of the phosphate present in the soil was limiting production. Date of sowing, 9th June, 1926 ; date of harvesting, 22nd January, 1927 ; variety, College Hunter's ; seeding, 1¼ bushels per acre. Previous history of field—1925–26, peas ; for several years prior to this the field was in grass. The soils from neighbouring fields, analysed at the Chemical Laboratory, were described as a loam and a silty loam respectively.

The manurial treatments applied per acre were—

(1) Control (no manure).
(2) Super, 42/44 per cent., 1 cwt.
(3) Nitrate of soda (15 to 16 per cent. nitrogen), 96 lb.
(4) Super, 1 cwt., and nitrate of soda, 96 lb.
(5) Super, 1 cwt., and sulphate of potash (48 per cent. K_2O), 1 cwt., plus nitrate of soda, 96 lb.
(6) No. 5 treatment, plus 1 cwt. carbonate of lime.

NOTE.—All nitrate of soda was applied on 9th September.

Eight replications of the above series were sown, the plots being one width of a seven-coulter drill and 6 chains long. Prior to sowing of the plots half the area was treated with carbonate of lime, at the rate of 17 cwt. per acre, in the following manner : The tubes were removed from the drill so that the lime could fall freely to the ground ; the coulters, which were left on, caught a good proportion of the lime and guided it into the soil, while somewhat more than half was broadcasted on the surface. This was done across the direction of sowing of the plots, the 3 chains in the middle being dressed. Thus

for 1½ chains from each end the plots were on *unlimed* ground, while the middle portions of 3 chains were on *limed* ground, as shown in the accompanying plan.

Carbonate of Lime, 17 cwt per acre
3 chains
1 ch. 18 ft
18'
1 ch. 18 ft
18'
1 ch. 18 ft
18'
1 ch. 18 ft
6 No 5 + 1 cwt Carbonate of Lime
5 Super 1 cwt. + Sulphate of Potash 1 cwt. + Nitrate of Soda 1 cwt
4 Super 1 cwt. + Nitrate of Soda 1 cwt
3 Nitrate of Soda 1 cwt
2 Super 1 cwt
1 No Manure
8 Replications
6 chains

FIG. 4. PLAN OF EXPERIMENT ON R. T. MCMILLAN'S FARM (NOT TO SCALE).

Dotted lines show where crosscuts have been made to subdivide plots.

FIG. 5. CUTTING THE PLOTS ON R. T. MCMILLAN'S FARM, IRWELL.

The outside divider of the reaping-machine is easily guided down the 14 in. space between the plots. The machine is driven on about 18 ft. past the end of plot, so that all material is delivered on to binding-table. The trip is then pressed and the material discharged before another plot is commenced.

[*Photo by the Writer.*

Method of Harvesting.

The area was divided into four blocks by cross-subdivision. A straight cut was first of all made across the ends of the plots to ensure their being of uniform length. Then three gaps, each 18 ft. wide, were cut, so as to divide the plots into four even lengths. These sub-lengths were therefore (1) on unlimed ground, (2) on limed ground, (3) on limed ground, (4) on unlimed ground. The gap of 18 ft. (equal to three widths of a reaping-machine cut) enabled cutting and clearing to be done expeditiously, as follows: Starting at either end, and cutting along each seven-coulter-wide plot, the machine would continue until the gap of 18 ft. was reached and crossed. By the time the gap was crossed the whole of the material from the sublength just cut would be delivered on to the binding-table. Hence, pressing the trip and rotating the discharge-arms were all that was required to clear the machine before commencing the next sublength, and material from limed ground was kept separate from that from unlimed ground (Fig. 5).

Observations during Growth.

9th September: At the time of applying nitrate of soda a very slight superiority in appearance of the manured plots over the controls (no manure) was reported. The whole crop was particularly vigorous and healthy in appearance.

15th November: The nitrate of soda had caused an increased growth on all plots to which it was applied. The colour, too, was slightly better than on the controls and super plots, although mildew and black aphis were in evidence, more particularly on the plots which had received nitrate of soda.

Later, flag-rust made its appearance, although in other respects the crop looked an excellent one. The results are given in Table 4 (next page).

Comments on Table 4.

Critical statistical examination of results has been applied to the comparisons made between one treatment and another on limed ground, and between treatments on unlimed ground. The comparisons between limed and unlimed ground do not lend themselves to such examination, but, as will be seen, some valuable indications are given.

(1) Fertilizers compared: (*a*) The increases from 1 cwt. of super —about 1 bushel and $\frac{3}{4}$ bushel on unlimed and limed ground respectively—cannot be considered profitable, although their significance is established. These figures confirm those of the seasons 1923–24 and 1924–25, and it is evident that application of phosphate to the wheat crop does not pay on this farm.

(*b*) The appearance of the crop in the spring and early summer indicated that nitrogen was not likely to be of much avail, although its application did stimulate growth. The increase over no manure of approximately $1\frac{1}{4}$ bushels on the unlimed ground, as compared with that of about $\frac{1}{8}$ bushel on the limed ground, points to the fact that the lime has assisted nitrification and reduced the effect from the applied artificial.

Table 4.—Results of Experiment 4.

[Area of individual subplot, $\frac{1}{110{\cdot}6}$ acre.]

Treatments: A compared with B.	Unlimed Ground.				Limed Ground.				Difference in Favour of Limed Ground.
	Number of Paired Plots.	Bushels per Acre. Yield.	Bushels per Acre. Diff.	Difference Significant (S.) or Non-significant (N.S.).	Number of Paired Plots.	Bushels per Acre. Yield.	Bushels per Acre. Diff.	Difference Significant (S.) or Non-significant (N.S.).	
A. No manure ..	10	49·14	..	..	10	51·39	..	..	2·25
B. Super, 1 cwt. ..		50·12	0·98	S.		52·11	0·72	S.	1·99
A. No manure ..	15	49·18	..	..	15	51·37	..	..	..
B. Nitrate of soda, 1 cwt.		50·45	1·27	N.S.*		51·69	0·32	N.S.	1·24
A. Super, 1 cwt. ..	15	50·23	..	..	14	52·30	0·22	N.S.	..
B. Super, 1 cwt., plus nitrate of soda, 1 cwt.		51·21	0·98	N.S.*		52·08	..	..	0·87
A. Super, 1 cwt., nitrate of soda, 1 cwt.	15	51·21	1·27	S.	14	52·07	0·05	N.S.	..
B. Manures "A," plus sulphate of potash, 1 cwt.		49·94	..	..		52·02	..	..	2·08
A. Super, 1 cwt., nitrate of soda, 1 cwt., sulphate of potash, 1 cwt.	16	49·88	..	..	15	51·91	0·32	N.S.	..
B. Manures "A," plus carbonate of lime, 1 cwt.		51·34	1·46	S.		51·59	..	..	0·25

* These increases from nitrate of soda, while not statistically significant, have chances of about 25 to 1 in their favour, and are probably real differences.

NOTE.—The differences between compared manures are shown in the "Difference" columns opposite the higher-yielding treatment of the two.

(*c*) Nitrate of soda applied to the super plots has behaved in much the same way as that applied to the no-manure plots (see preceding paragraph). On the limed ground the effect of the nitrogen is nil, as shown by the slight non-significant difference.

(*d*) The addition of potash to the phosphate and nitrogen on the unlimed ground has caused a *definite* depression in yield to the extent of about 1¼ bushels per acre. Apparently the lime has neutralized this adverse effect, with the result that the mixture of phosphate, nitrogen, and potash on the limed ground has yielded practically the same as the phosphate-nitrogen combination.

(*e*) The final comparison shows a difference in favour of the B mixture containing 1 cwt. of lime. The small amount of lime applied with the manure has corrected the depression caused by the potash. Whether the addition of 1 cwt. lime to a mixture not containing potash would have caused an increase, or whether the lime has merely overcome

the bad effect of potash, is problematical. The following suggests that the lime would in itself have caused an increase.

(2) Unlimed compared with limed: (*a*) The no-manure and super plots on limed ground show increases over similar plots on unlimed ground of $2\frac{1}{4}$ and 2 bushels per acre respectively.

(*b*) The limed-ground increase on the plots receiving nitrate of soda alone and super plus nitrate of soda are smaller, being $1\frac{1}{4}$ bushels and about $\frac{9}{10}$ bushel respectively. The similarity in behaviour of these plots certainly supports the contention made above that the liming has encouraged nitrification and reduced the effect from the applied artificial. This is supported by the fact that on the no-manure and the super plots the limed ground shows up more favourably.

(*c*) The phosphate-nitrogen-potash combination on limed ground is better than that on the unlimed by just over 2 bushels per acre. If the depression due to potash on unlimed ground is subtracted from this (or added to the yield of the plot receiving potash) the figure 0·81 bushel is obtained. This is very close to the difference already shown between the super plus nitrate of soda plots on limed and unlimed ground.

(*d*) The last comparison between the plots on limed and unlimed ground is the only one in which the limed ground has failed to register an appreciable increase over unlimed. As already mentioned, the arrangement of the plots does not lend itself to critical examination of comparison between limed and unlimed ground. The fact that all plots, except those receiving 1 cwt. of lime, have given increases ranging from 0·87 to 2·25 bushels per acre on the limed ground is very strong evidence in favour of the beneficial effect from lime. It is hoped that further tests will be conducted in the future to settle this point.

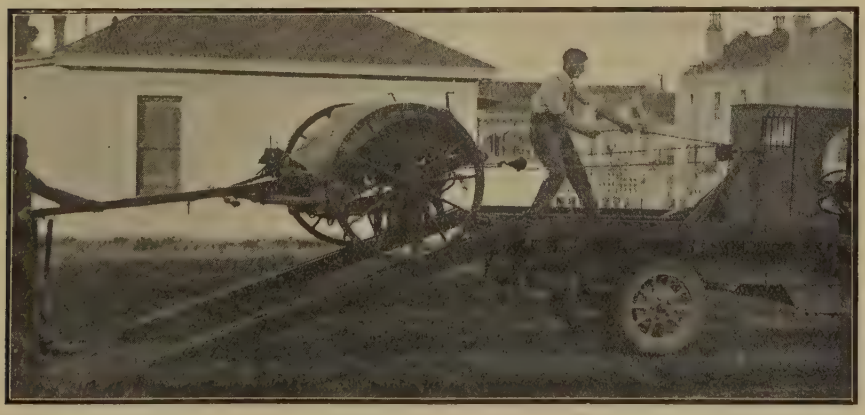


FIG. 6. LOADING THE DRILL USED BY FIELDS DIVISION FOR SOWING CEREAL, RAPE, AND TURNIP EXPERIMENTS.

Transport by motor-lorry enables maximum amount of work to be carried out expeditiously. The skids up which drill is pulled are carried in brackets seen on side of lorry. Pole of the drill is clamped to back of lorry to prevent movement on road.

[*Photo by the Writer.*

Experiment 5 : Ashburton Experimental Farm.

In continuation of an experiment described in the *Journal* for November, 1926, page 319, in which the proprietary manure "Ammo-Phos" was tried against superphosphate and super plus sulphate of ammonia, a further trial was made in the past season, again on spring-sown wheat. Date of sowing, 19th August, 1926; date of harvesting, 11th February, 1927; variety, Solid-straw Tuscan; seeding, 1½ bushels per acre. History of field—1925-26, potatoes; 1924-25, barley; 1923-24, fallow, following oats and vetches.

The manurial treatments were as follows :—

(1) Control (no manure).
(2) Superphosphate, 42/44 per cent., 104 lb.
(3) Super, 42/44 per cent., 104 lb., plus sulphate of ammonia (20 per cent. nitrogen), 82 lb.
(4) Ammo-Phos (20/20 grade),* 100 lb.

* NOTE.—Ammo-Phos, 20/20, contains 20 per cent. ammonia (= 16·4 per cent. nitrogen) and 20 per cent. phosphoric anhydride. Owing to the very limited area of suitable ground being available, the 13/48 grade of Ammo-Phos used in the previous year had to be omitted from the present experiment.

Observations during growth : Soon after coming through the ground all manured plots showed a marked and equal superiority in growth over control. The plots receiving nitrogen, although not noticeably better in growth than the super plot, showed a much deeper green colour than the latter, which by comparison looked decidedly yellowish.

The results are shown in the following table :—

Table 5.—Results of Experiment 5.

[Plots repeated 25 times. Area of individual plot, $\frac{1}{87{\cdot}5}$ acre.]

Treatments : A compared with B.	Number of Paired Plots.	Bushels per Acre.		Difference Significant (S.) or Non-significant (N.S.).
		Yield.	Difference in Favour of A.	
A. Super, 104 lb.	25	45·3	3·3	S.
B. Control		42·0	..	..
A. Super, 104 lb., and sulphate of ammonia, 82 lb.	25	48·5	3·2	S.
B. Super, 104 lb.		45·3	..	..
A. Ammo-Phos (20/20), 100 lb. ..	25	48·9	0·4	N.S.
B. Super, 104 lb., and sulphate of ammonia, 82 lb.		48·5	..	..

Comments on Table 5.

(1) The increase of nearly 3⅓ bushels per acre due to super is quite paying, leaving a net profit of about 11s. per acre. In the preceding year super did not give any increase.

(2) The super and sulphate of ammonia combination has proved better than super by 3·2 bushels per acre. This increase, due to the sulphate of ammonia, while considerable, only just pays for the nitrogen addition. In the preceding year the same amount of sulphate of ammonia caused an increase of 5⅓ bushels per acre.

(3) Ammo-Phos and the mixture of super and sulphate of ammonia, both of which contain the same amount of fertilizing constituents per acre, show no significant difference in yield. In the 1925–26 season the mixture proved better than the Ammo-Phos by $\frac{4}{5}$ bushel per acre.

General Conclusions.

(1) With the exception of the Irwell experiments, readily available phosphates continue to give profitable returns when used at 1 cwt. per acre.

(2) In the districts under review there is no encouragement to use a greater quantity than 1 cwt. per acre with the wheat crop.

(3) Potash, so far as its trial has progressed, is in the main useless, and in some cases worse than useless in that it has depressed yield.

(4) Nitrogen in the soluble form of nitrate of soda or sulphate of ammonia has given sufficiently good results to warrant its trial on crops which tend to be backward in growth and of poor colour in the spring. It should not be applied before the middle of September. More experimental evidence is required before its general use on backward crops can be recommended.

The continued co-operation of the farmers named is sufficient evidence that their assistance and interest are appreciated by the Department, and that the Department's work is appreciated by them. For the carrying-out of much of the field-work and the tedious working out of results thanks are due to Messrs. Calder, Bates, Bryden, and Hardy, of the Fields Division staff in Canterbury.

FARMING OF "BUSH-SICK" COUNTRY.

THE position with regard to bush-sickness or soil-deficiency disease in the affected North Island district is stated by the Director of the Live-stock Division (Mr. J. Lyons) in his annual report for 1926–27 as follows:—

"That a considerable improvement has been effected on many of the farms within the bush-sick area is apparent to any one familiar with the district during the past decade. On many of the farms dairying is being carried on with reasonable hope of ultimate success, where a few years ago it was impossible to carry stock of any description successfully. A good example of this is to be seen in our own experimental farm at Mamaku. During the past few seasons dairying has been carried on with increasing success. From a herd of some twenty-odd cows milked during the past year the returns were good, and the animals maintained their health throughout the season. In fact, their yield and condition were in excess of that hoped for by those knowing the district a few years ago. The altered conditions have been brought about simply by better farming methods—viz., laying down good pastures, suitable top-dressing, frequent changes, and growing roots and hay for winter feed. Notwithstanding the knowledge we have acquired, this is difficult country for the average settler to bring into a satisfactory state of cultivation. The success of the venture depends to a great extent on the amount of capital at his disposal. A larger amount is required than for outside country, and the average man going on the land has not the necessary finance. The result is a continued struggle, with the not infrequent result in the past that the settler has had to abandon his land.

"The value of citrate of ammonia and iron as a curative agent in this trouble has been demonstrated during the past season. Large quantities have been sold at cost price, and there is still a good demand for it by settlers in the affected areas."

FARMERS' FIELD-CROP COMPETITIONS.

TARANAKI-WANGANUI DISTRICTS, SEASON 1926–27.

J. W. DEEM, Instructor in Agriculture, Wanganui.

FARMERS' field-crop competitions were carried out in fifteen centres of the Taranaki-Wanganui districts during last season, against twelve in 1925-26. Although there were more centres competing, the crops actually judged were somewhat fewer, the numbers being 231, against 254 in the preceding year, a decrease of twenty-three. The crops consisted of the following: Mangolds, ninety; carrots, sixty-one; swedes, forty-nine; turnips, nine; lucerne, sixteen; and chou moellier, six. In addition to these, three ensilage-judging competitions were held, a total of thirty-seven stacks and pits being judged. The lucerne and soft turnips were judged in February, and the mangolds, carrots, swedes, and ensilage between 20th May and the middle of July. A very fine exhibit was again staged at the Hawera Winter Show.

As pointed out in previous reports, these competitions have a valuable educative value for those who care to follow them up. The results from year to year clearly demonstrate the best methods of cultivation, the best varieties to grow, weight of seeding, manures to use, &c. From the instructional staff's standpoint, moreover, nothing could afford a better opportunity of keeping in touch with the farmers and agricultural methods of the district.

Mangolds.

Sowing operations were greatly delayed owing to very unseasonable weather, and many farmers had to resow. This made them late, and it was thought that the average crops would be considerably lighter than usual. However, the judging returns show an average of 59 tons 13 cwt., against 59 tons 14 cwt. last year, which is very close. The good results obtained under very adverse conditions must be attributed to better methods of cultivation, &c.

Varieties.

Prizewinner Yellow Globe still holds pride of place, although some very fine crops of Orange Globe were also judged. This latter is a very good cropper, but has a heavy top that is hard to cut or break off, and the root is slow in ripening. The placings of the varieties in the fifteen competitions were as follows: Prizewinner Yellow Globe, eleven firsts, nine seconds, nine thirds; Giant Orange Globe, three firsts, two seconds, two thirds; Yellow Globe, one first; mixed varieties, two seconds, one third; Jersey Queen, one second, one third; Long Red, one third. The averages were: Prizewinner, fifty-six crops, 61 tons 6 cwt.; Giant Orange Globe, sixteen crops, 65 tons 17 cwt.; Long Red, three crops, 41 tons 2 cwt.; Jersey Queen, four crops, 53 tons 15 cwt.; mixed varieties, nine crops, 55 tons 8 cwt. Red Intermediate is a mangold that has done well right through South Taranaki in connection with boys' and girls' clubs, and will probably figure among the competitions next year.

Championship Crops.

Particulars of the championship crops winning the Sutton Cups in their respective districts are as follows:—

Wanganui: W. Stephenson, Maxwelltown — Prizewinner Yellow Globe, grown after carrots; yield, 71 tons 5 cwt. per acre; sown 14th November in drills 26 in. apart; manure, super 5 cwt.; seed, 6 lb. per acre. Mangolds were lighter in this district than in the preceding year, the average being 55 tons 10⅓ cwt., against 59 tons 18 cwt.

South Taranaki: H. Betts, sen., Okaiawa—Area, ½ acre; Giant Orange Globe, after lucerne; sown in October in garden, and transplanted first week in November in drills 18 in. apart; mangold-manure, 2 cwt., and kainit, 2 cwt., per acre, plus some stockyard manure over a portion of the field; yield, 128 tons 19 cwt. Full marks were given for cultivation. It is interesting to note that this crop was transplanted, and that practically the whole of the work was done by Mr. Betts, who is in his ninety-first year.

North Taranaki: J. B. Hine, Toko—½ acre; Prizewinner Yellow Globe; yield, 90 tons 11 cwt.; sown 2nd November; seed, 6 lb.; drills, 18 in.; manure, 7 cwt. super and 5 cwt. salt per acre; mangolds following mangolds. This is the third crop of mangolds grown on this area in succession. The weights of the respective years are as follows: 1925, 89 tons 7 cwt.; 1926, 111 tons 13 cwt.; and 1927, 90 tons 11 cwt. This area was originally a holding-paddock near the cow-shed, and no doubt received a lot of cow-manure. As a general practice the growing of mangolds on the same land for several years is not recommended, but many cases have come under notice where very fine crops have been grown for several years in succession.

Another very fine crop was that grown by Mr. C. Willis, Matapu: Orange Globe, 96 tons 1 cwt., grown in 18 in. drills, with 5 cwt. mangold-manure. Mr. Willis has won the Sutton Cup for South Taranaki twice, and was runner-up this year.

Width of Drills and Amount of Seed per Acre.

The findings under this heading last year are borne out by this year's results—namely, that drills 21 in. to 25 in. apart, and seed 5 lb. to 7 lb. per acre, give on the average the best results. It is true that the heaviest crops this year were grown in 18 in. drills, and if the grower has time to do all the work by hand, and does it properly, he will get a wonderful crop under these conditions. The wider drills allow of a great deal of the work being done by the horse-hoe.

Manures.

This year's results again demonstrate the fact that any good phosphatic-manure mixture, provided it has a fair amount of super and is applied in reasonable quantities, will give good results, particularly if supported with from 3 cwt. to 5 cwt. of salt or kainit. It will be noticed from Table 1 that eight crops which had 6 cwt. phosphates plus 3 cwt. salt per acre gave an average of 65 tons 4 cwt., being 5 tons 11 cwt. above the average for all crops; while eleven crops that had

4 cwt. phosphates plus 3 cwt. kainit averaged 64 tons 1 cwt., or 4 tons 8 cwt. above the average. Had the kainit-manured crops been supplied with the same amount of phosphates it is probable that they would have given a better average than those which received salt; but both returns go to show the advantage of using either salt or kainit.

Table 1.

Number of Crops.	Manure.	Average Weight of Manure per Acre.	Weight of Crop per Acre.
		Cwt.	T. cwt.
2	Basic super	5	68 18
2	Basic super	5	71 0
	Kainit	5	
7	Super and bone	5	55 0
12	Super and bone	5	54 0
	Potash salts	1	
37	Proprietary manures	5	58 2
8	Mixed phosphates	6	65 0
	Salt	3	
11	Mixed phosphates	4	64 1
	Kainit	3	
8	Super	4	60 11

The mixed phosphates were mostly made up as follows: 3 parts super, 1 part bonemeal, and 1 part Nauru rock phosphate, or 3 parts super and 2 parts bonemeal or Nauru.

The following table gives particulars of the best twelve crops:—

Table 2.—Twelve Best Crops of Mangolds.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Remarks.
	T. cwt.		In.	lb.	Cwt.		
Orange Globe ..	128 19	1/11/26	18	Trans-planted	4	2 cwt. mangold-manure, 2 cwt. kainit, plus cowyard manure	After lucerne.
Orange Globe ..	96 1	2/11/26	18	4	5	Proprietary manure ..	After grass, ploughed twice.
Prizewinner ..	90 11	2/11/26	18	6	12	7 cwt. super, 5 cwt. salt	After two crops of mangolds.
Prizewinner ..	86 11	25/10/26	21	6	8½	3 cwt. super, 1 cwt. bone, 1 cwt. Nauru, ½ cwt. potash, 3 cwt. hide salt	Lea land, ploughed in August.
Prizewinner ..	80 17	12/11/26	21	6	4	Proprietary manure ..	After swedes.
Prizewinner ..	79 13	28/10/26	28	6	5	2 cwt. bone, 2 cwt. super, 1 cwt. sulphate of potash	After green oats.
Orange Globe ..	77 15	28/10/26	24	7	4	Mangold-manure ..	After swedes.
Prizewinner ..	74 15	18/11/26	22	8	8	Bone, super, slag, and sulphate of potash	After mangolds.
Prizewinner ..	74 14	18/10/26	21	4	4	Basic super	After barley.
Prizewinner ..	74 12	12/11/26	21	4½	9	4 cwt. basic super, 5 cwt. kainit	After swedes.
Prizewinner ..	73 4	28/11/26	21	5	7	5 cwt. super, 1 cwt. bone, 1 cwt. 30-per-cent. potash	Lea land, ploughed once.
Prizewinner ..	71 12	24/11/26	18	5	5½	2 cwt. bone, 1½ cwt. super, 1½ cwt. Nauru, ½ cwt. sulphate of potash	Lea land, ploughed once.

Carrots.

Difficulty was experienced in getting a strike with early-sown crops, but after they got a start they did well. Sixty-one crops were judged, against fifty-seven last year. The average weight was 45 tons 8 cwt., as compared with 44 tons 12 cwt. last year. A number of varieties were judged, but first place is again taken by Matchless White. This variety is bad for bolting to seed, but even with this fault it seems to give the best all-round crops for pulling and feeding out. Guerande was seen only in the Maxwelltown district, where considerable areas are grown for sheep. This carrot weighs out well, and should be more generally grown for sheep-feeding. It is, of course, excellent for cows, but takes a lot of handling when being pulled and carted out. Following are some particulars of crop yields: Twenty-seven Matchless White averaged 47 tons 14 cwt.; five Sinclair's Champion, 46 tons 10 cwt.; three Barriball, 47 tons 9 cwt.; three Guerande, 56 tons 9 cwt.; three Yellow Intermediate, 38 tons 15 cwt.; two White Belgian, 47 tons; two Magnum Bonum, 44 tons 4 cwt.; fifteen mixed varieties, 40 tons 15 cwt. Of the eleven competitions judged, Matchless White won eight firsts, four seconds, and six thirds; Sinclair's Champion, two firsts, one second, and two thirds; Yellow Intermediate, one first and one second; Guerande, one first and one second; mixed varieties, one second and two thirds. The poor showing of the mixed varieties was no doubt due to inferior seed. Generally these carrots would be sown as a definite variety, but when pulled were found to contain several varieties of inferior quality. There is far too much of this inferior carrot-seed on the market. The next table gives particulars of the best twelve crops.

Table 3.—Twelve Best Crops of Carrots.

Variety.	Yield. per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Remarks.
	T. cwt.		In.	lb.	Cwt.		
Matchless White	68 1	14/11/26	24	1¼	4	Mangold-manure ..	After grass.
Matchless White	66 6	12/11/26	16	1	3	Carrot-manure ..	After oats.
Matchless White	64 7	19/11/26	22	1	8	Bone, super, slag, and 30-per-cent. potash, equal parts	After mangolds.
Guerande ..	62 3	10/11/26	24	1¼	4	Mangold-manure ..	After swedes.
Matchless White	61 2	12/11/26	14	2	4	Carrot-manure ..	After soft turnips.
Guerande ..	59 2	2/11/26	14	1½	2	Super	After lea, ploughed once.
Barriball ..	58 7	13/11/26	14	1	4	Carrot-manure ..	After swedes.
Sinclair's Champion	55 1	2/12/26	14	½	2	Super	After lea, ploughed once.
Matchless White	54 10	1/11/26	24	3	4½	Super	After potatoes.
White Belgian ..	53 14	1/11/26	24	3	4½	Super	After potatoes.
Matchless White	51 17	20/11/26	16	1	5	Super, blood and bone, salt, and potash	After grass, ploughed in September.
Matchless White	51 10	17/11/26	14	2	3	Carrot-manure ..	Lea land, ploughed once.

There is a considerable variation in date of sowing, but it appears safe to say that the best time for the larger varieties is between the last week of October and the middle of November, using from 1 lb. to 1¼ lb. of seed per acre. Guerande carrots should not be sown so early unless required for early autumn feed, as they mature quicker; the best time is from the middle to the end of November, but many

good crops have been sown as late as the middle of December. These carrots are best sown on ridges 21 in. apart, at the rate of 1½ lb. of seed, and given intercultivation, but not thinned.

Manures.

These again show a wide variation, but it would appear that any good phosphate manure or mixture of phosphate and potash, used at from 3 cwt. to 5 cwt. per acre, is suitable for carrots. Unless sowing with a ridger, which puts some of the manure well down, it is found advisable to broadcast half of the manure just before the last harrowing and apply the remainder with the seed. If too much manure is sown near the surface with carrots there is a tendency for them to fork. The rates of manuring are interesting: Five crops which received 2 cwt. manure averaged 42 tons 6 cwt. in yield; seventeen crops at 3 cwt., 43 tons 9 cwt.; twenty-one at 4 cwt., 47 tons 11 cwt.; five at 5 cwt., 44 tons; two at 6 cwt., 49 tons 14 cwt.; two at 8 cwt., 34 tons 3 cwt.; and one at 9 cwt., 46 tons 14 cwt.

Swedes.

More farmers grew swedes than for some years past, and, on the whole, quite good crops were secured. A considerable number of crops were more or less affected with club-root. The decrease in the number of crops affected with dry-rot was maintained this year, and, with the exception of a few crops about Otakeho, very little of the disease was found. The average weight of crops judged this year was 44 tons 5 cwt., compared with 41 tons 6 cwt. last year. Now that dry-rot is not so prevalent the old favourite, Superlative, is being more extensively grown. In nine competitions Superlative gained three firsts, Masterpiece two, Magnum Bonum two, Grandmaster one, and Monarch one. The general weights of manure ran from 2 cwt. to 4 cwt. per acre; ten crops receiving 2 cwt. averaged 41 tons 17 cwt.,

Table 4.—Ten Best Crops of Swedes.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Remarks.
	T. cwt.		In.	Oz.	Cwt.		
Masterpiece ..	64 2	19/12/26	14	14	1½	Half super, half bone ..	After grass, ploughed in October.
Superlative ..	61 17	10/12/26	7	9	4½	1½ cwt. super, 1½ cwt. slag, 1 cwt. bone, and ½ cwt. sulphate of potash	After grass, ploughed once.
Superlative ..	54 12	10/12/26	7	14	3	Half super, half bone ..	After grass, ploughed in September.
Superlative ..	54 11	21/12/26	14	9	3	Basic super	After grass, first ploughing.
Crimson King ..	53 16	24/12/26	7	14	4½	Third each slag, super, and bone, plus 20 lb. sulphate of potash	After grass, ploughed in November.
Masterpiece ..	51 14	20/12/26	14	15	3	Basic super	Lea, ploughed once.
Superlative ..	51 10	22/12/26	14	9	2½	Basic super	Virgin land, ploughed in November.
Superlative ..	50 5	18/12/26	7	16	3	Basic super	After grass, ploughed in August.
Monarch ..	49 9	25/11/26	14	10	3½	1½ cwt. super, 1½ cwt. bone, ½ cwt. sulphate of potash	After grass, ploughed in October.
Grandmaster ..	49 6	14/12/26	7	10	4	Turnip-manure ..	After grass, ploughed in October.

twenty-nine which had 3 cwt. averaged 43 tons 1 cwt., and nine at 4 cwt., 48 tons 13 cwt. Four crops fertilized with bone and super averaged 51 tons 2 cwt.; seven with basic super, 47 tons 3 cwt.; twenty-one with proprietary manure, 42 tons 3 cwt.; six with super, 39 tons 4 cwt.; and four with super, bone, and potash, 42 tons 8 cwt. The addition of potash does not appear to have increased the weight of the crops, but it may have slightly improved the feeding-value.

Table 4 gives particulars of the ten best crops.

Soft Turnips.

There was only one competition in soft turnips during the season under review, and the average crop was 36 tons 6 cwt., against 36 tons last year.

Lucerne.

Only two competitions in lucerne were conducted, sixteen crops being judged. The wet weather about Christmas, followed by a sudden dry snap, rather upset some growers' calculations; consequently many of the crops were in a very uneven stage of growth at judging-time, and in these cases the competitions were not gone on with. The crops judged were very good on the whole. A few crops that were very dirty last year, and created doubts as to their ultimate success, showed a wonderful improvement, giving a splendid demonstration of what can be done by careful treatment.

In last year's report (*Journal* for September, 1926) I mentioned J. Clague's fine crop of lucerne. This crop won again in the Manaia competitions, scoring 48 out of a possible 50 points, against 49 last year. The treatment given in the interval, apart from cultivation, was a top-dressing with 3 cwt. of super per acre. The 8-acre field on the Waimate West Demonstration Farm scored 46 points, against 48½ last year. The drop in points was owing to unevenness and coarseness in a portion of the area which is in wide drills.

Chou Moellier.

There were two small competitions with this fodder during the past season, and only six crops were weighed and judged. The winner of the Toko competition, G. Cook, had a very nice crop which yielded 33 tons 15 cwt. per acre. The six crops averaged 26 tons 8½ cwt., and as they were fair average crops it may be accepted that a fair crop of chou moellier weighs between 26 and 30 tons.

Ensilage.

The making of ensilage has come very much to the fore in Taranaki during the last three or four years, and in some districts fully 90 per cent. of the farmers adopt this means to supply part or whole of their supplementary fodder. The usual method of saving is by the stack, but there are a good many pits and a few silos. This year the three districts holding judging competitions provided farmers with a good opportunity of observing different methods of saving, and altogether a very interesting and educative time was spent and some excellent ensilage seen.

The judging was done on points as follows: A maximum of 50 for uniformity and quality, 25 for minimum waste, 20 for covering, and 5 for site, making a total of 100 points. The ensilage is judged in the stack or pit, it being a condition that all material must have been cut so as to expose a face. These competitions are likely to become very popular, and already arrangements have been made to hold several more next year. Table 5 gives particulars of the three first placings in each competition.

Table 5.

Name of Competitor.	Uniformity and Quality.	Minimum Waste.	Covering.	Site.	Total.	Remarks.
			Lepperton (9 entries).			
H. E. Blyde ..	42	22	18	3	85	Round pit; grass and oats.
H. Wallace ..	43	20	15	4	82	Round stack; grass.
D. B. McKee..	41	22	14	4	81	Square pit; grass.
			Tikorangi (15 entries).			
J. Paulger ..	42	20	16	5	83	Square stack; grass.
F. Blyde ..	43	19	15	5	82	,, ,,
N. L. Sarten ..	42	17	14	5	78	,, ,,
			Tokaora (13 entries).			
H. Batten ..	42	24	20	5	91	Concrete silo; lucerne.
N. Wren ..	43	20	18	5	86	Round pit; grass.
H. Wren ..	43	19	17	5	84	,, ,,
J. A. McCallum	41	18	14	5	78	Square pit; lucerne.

Although Mr. Batten entered his silo and had it judged, he generously withdrew it from the competition in so far as the prizes were concerned, recognizing that it was too big a handicap for farmers with stack or pits to compete against a properly constructed silo.

In conclusion, I should like to express my appreciation of the work done by Messrs. A. J. Glasson and J. M. Smith, Instructors in Agriculture, who were associated with me in judging several of the competitions.

Compensation for Condemned Stock and Meat. — For the financial year of 1926-27 the Department of Agriculture paid out compensation totalling £15,715 on 5,199 animals condemned in the field for diseases under the Stock Act, and £13,963 for carcases or parts of carcases condemned at abattoirs and meat-export works, under the Slaughtering and Inspection Act. The aggregate of these amounts represents a decrease of £1,205 compared with the figures for 1925–26.

Casein-manufacture. — In connection with the last dairying season the Director of the Dairy Division remarks that the quality of casein continued of a uniformly high standard. Rennet casein commands a high market value, being particularly low in butterfat content. Quantities manufactured for export show a slight increase over the preceding year of 14½ tons, the figures being 1,613½ tons lactic and 151 tons rennet casein, as against 1,126 tons lactic and 624 tons rennet.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT AND THE FEEDING OF STOCK.

THE appearance of abundant rank grass in pastures at the end of November is frequently followed by a sharp drop in milk-yield by dairy cows and a check in the growth of lambs. It is the short pasture grass about 4 in. high that is really efficient as a milk-producer. The fall in milk-yield is due to the fact that rank grass is not so nutritious as short grass. Close subdivision and rotational grazing will help to prevent the grass getting unduly long. On dairy farms the mower should always be used to clear off any surplus rank growth. If the growth is heavy it can be made into hay or ensilage, or, if light, left in the field and the young dry stock on the farm turned in to eat it up as soon as it is wilted. On many farms the mowing of the rank growth is left rather late, not being done till January or February. Early mowing is important, because the autumn growth of grass is thereby increased. In the case of breeding-ewes, cattle are necessary to keep the pastures short enough for the ewes and lambs. Young growing cattle are usually the best for keeping rank growth down. Mature fattening bullocks require the best grass if they are to fatten quickly. The popularity of dairy heifers as the main type of cattle-beast carried on many fat-lamb-raising farms is that the young growing animals can be made to eat rank grass more readily than fattening animals. Too much grazing of rank pasture grass, however, is not good for young growing cattle, especially dairy heifers, as they require protein-rich fodder just as much as milking-cows or growing lambs.

LUCERNE.

Established stands of lucerne are generally ready for the first cutting some time in November. It is unwise to cut too early, as this usually reduces the weight and number of subsequent cuts. Flowering is frequently late in the spring, and the stage to cut is often determined by the appearance of fresh buds at the base of the crown. As the weather is often unsettled in November the first cut of lucerne on dairy farms is preferably made into ensilage. For this purpose it should be stacked along with grass from early-mown pastures. This is usually necessary because on most farms insufficient material is available from the lucerne-field alone to make a satisfactory stack, and also because the quality of the silage is better when lucerne is mixed with grass.

November is usually the best month to sow new stands of lucerne. The success or otherwise of a stand of lucerne depends on many circumstances, but the main factors are the soil-conditions and the climate. Lucerne naturally does best in a warm, dry climate and a deep alluvial soil well supplied with moisture in the deeper layers. As a fodder plant its successful cultivation on a large scale is restricted to districts where the summer climate is warm and dry, the winter not too severe, and the soil fertile and deep. Its culture in England, for example, has

extended over several hundred years, but it is only grown at all largely in the two driest counties, Essex and Kent. Its use in the United States is mainly in the low-rainfall areas in the western half of the country. It has been grown and experimented with in all parts of New Zealand with more or less success, but it is only extensively cultivated in Marlborough and the low-rainfall districts of Otago. In a wet climate it has to contend against the competition of grass and clover, which in many parts of the North Island take possession of the land during the winter and early spring when the lucerne is dormant. A small area of lucerne is a very valuable permanent fodder crop on many North Island dairy farms, but in selecting the site for the sowing of any new areas great care should be exercised to see that the land chosen is well drained in the winter. Success in growing lucerne in many parts of the North Island has been much more marked since the adoption of the practice of regularly top-dressing the stand with phosphatic fertilizers, and so keeping the plants in a vigorous condition.

The seed-bed for lucerne should be carefully prepared. The crop frequently does best after grass, but care should be taken to see that the land is free from twitch. The land should be ploughed in the late winter or early spring so as to allow plenty of time for the grass to rot. Lime is generally applied at the last cultivation and disked in. The seed-bed should be fine and firm, and rolled before drilling. Colonial or Hunter River seed is usually the most satisfactory. The quantity of seed sown depends on the climate and the method of sowing. In the drier parts of the South Island 10 lb. to 14 lb. for broadcast or drilling in 7 in. rows: for 14 in. or 21 in. rows 10 lb. or 8 lb. is usually enough; in the wetter districts 15 lb. to 18 lb. is usually sown. Inoculation should be carried out either by mixing the seed with inoculated soil or by broadcasting 2 cwt. to 3 cwt. of inoculated soil over the field on a dull day before drilling, and disking it in. If inoculated soil cannot be economically obtained the proprietary culture known as Farmogerm may be used on the seed. In practically all cases phosphatic fertilizers should be sown with the seed, 2 cwt. to 3 cwt. of superphosphate being the standard application.

Many promising stands of lucerne have been ruined by too early cutting in the first year. The first cutting should not take place till the young plants are blooming and fresh buds have appeared at the base of the plant. Cutting before this stage is reached greatly weakens the vigour of the young plants.

ROOT CROPS.

The main sowings of soft turnips, Aberdeen turnips, and swedes take place in November. No general rule for time of sowing can be laid down, as conditions vary so greatly in different districts. In Canterbury the attacks of the grass-beetle on the newly germinated plants is often serious with November sowings. The root-crop competitions, where they have been carried out for a number of years, have given very valuable information as to the best time for sowing in particular localities. In many districts carrots and mangolds are not sown till November, and in any year when October is wet and cold it is usually best to delay sowing till the late period.

GREEN FORAGE CROPS AND CATTLE-PUMPKINS

The main sowings of rape, kale, chou moellier, millet, and maize for green fodder should be made during November. Mustard or Italian rye-grass should be sown with the rape; with mustard it is best sown after the rape is up in two rough leaves, so that both crops may mature together. Japanese millet should not be sown too early; any time after the middle of November in the warmer localities, and the first week in December in the colder districts, is quite soon enough.

Cattle-pumpkins are a valuable supplementary feed for the late autumn and early winter on many North Island dairy farms. The crop is preferably cultivated near the milking-shed, so that the accumulated yard manure can be used for fertilizing the plants. Although the crop can be successfully grown without yard manure, the yield is greatly increased by its use. Holes should be made about 10 ft. apart, a barrow-load of manure dug in and well incorporated with the soil, and three or four seeds planted above it. Generally speaking, the crop will not keep beyond the end of June.

TEMPORARY AND SHORT-ROTATION PASTURES.

In many parts of the South Island kale is being grown to replace swedes and turnips for late winter and early spring feeding. Most years, however, the land for kale is not ready for ploughing till September or October, and the land can often be more profitably sown in a temporary pasture of Italian rye-grass, or Italian rye-grass and red clover, after it is broken up. A temporary pasture sown in November throws a very large amount of autumn feed of high palatability. The provision of a temporary pasture of this nature will reduce the amount of cereal catch-cropping necessary for autumn feed, and will also provide good winter and early spring feed.

Large areas of short-rotation grassland in Canterbury are usually sown down with rape in November. This provides for cheap establishment of the grassland, and prevents the young pasture being destroyed by the grass-grub, but on light land often results in an indifferent pasture in dry years.

—P. W. Smallfield, Instructor in Agriculture, Ruakura.

THE ORCHARD.

SPRAYING.

THE majority of apple-trees will now be blossoming, a stage at which, as far as possible, trees should not be sprayed. Weather conditions are often favourable for the development of black-spot about this time; consequently it is advisable to spray again as soon as about 75 per cent. of the blossoms have fallen, or at what is termed the petal-fall or calyx stage.

From now on till the fruit-set stage is a critical time, and careful consideration must be given if the best results are to be obtained. In some districts, and with some varieties, dropping of fruit is bad, while black-spot is liable to put in an appearance at any time. At the calyx period it has been found beneficial to spray with either a combination

of lime-sulphur and one of the sulphur pastes, or with a sulphur paste alone, according to variety. If the weather conditions are favourable, and there is no black-spot in evidence, a sulphur paste at strength of 6 lb. to 8 lb. per 100 gallons of water on the more tender varieties, such as Dunn's and Cox's Orange, will do much to prevent dropping. This spray, although not as good a fungicide as lime-sulphur, appears to act as a tonic to the tree, especially in cases where lime-sulphur has been used three or four times up to the calyx period. On the other hand, if the weather conditions are favourable for the development of black-spot, it is advisable to use lime-sulphur at strength 1–100 with the addition of about 4 lb. of sulphur paste. The addition of the paste will help to prevent dropping, while the lime-sulphur will prevent the germination of any spores of black-spot that may be about. Where a grower is only considering the prevention of black-spot and not the export of fruit, bordeaux at strength of 3-4-50 can be used. This spray may possibly check black-spot more than lime-sulphur, but the fruit will be considerably russeted.

Up to the present black-spot has mainly occupied attention, but from this stage onward the various pests of the orchard will have to be considered. Fortunately, some of them—red mite, leaf-hopper, &c.—can be kept in check with lime-sulphur, but the control of others, such as codlin-moth and leaf-roller caterpillar, requires a poisonous spray. Some orchardists are of the opinion that the combination of lime-sulphur with arsenate of lead is the cause of much burning of foliage and dropping of fruit. No doubt the best procedure is to spray separately, and if time can be found this practice is to be recommended, but where a large area has to be dealt with it is often found impossible to carry out separate sprayings. The addition of milk of lime (from 2 lb. of fresh lime per 100 gallons of spray) to neutralize any free arsenic will help considerably to minimize the chance of burning. The extra amount of arsenate of lead used by some growers may be the cause of much burning, and is not to be recommended. If the spraying is done thoroughly the quantity of lead advised is quite sufficient to cope with any attacks from codlin-moth. Lime-sulphur at strength 1 in 100–120, plus arsenate of lead 1½ lb. to 2 lb. powder or 3 lb. paste, plus 4 lb. sulphur paste per 100 gallons, plus milk of lime from 2 lb. fresh lime, sprayed at the fruit-set period, will prove satisfactory in coping with black-spot, red mite, codlin-moth, and leaf-hopper. The addition of a spreader is advised with all sprays, but more especially when the foliage is on the trees.

Another spraying of pears with bordeaux at strength 3–4-40, or lime-sulphur 1 100 120, plus arsenate of lead, is recommended for the control of black-spot and codlin-moth.

About three weeks after the fruit is formed stone-fruits should receive another dressing of lime-sulphur 1-120, plus 3 lb to 4 lb. of sulphur paste, for the control of brown-rot. It is also advisable to go carefully over the trees, thinning out and destroying any fruits affected with brown-rot. This will help to prevent the spread of the disease to healthy fruits.

CULTIVATION AND MANURING.

Cultivation of the orchard when the fruit-trees are being taxed to the utmost at the fruit-setting period is most important. To lose soil-moisture at this time of the year is often disastrous. Retain this

moisture by the constant use of the disks and harrows. After the soil is well worked down it is only necessary to stir it to a depth of from 3 in. to 4 in., keeping it loose, so as to allow free access of air into the soil. If possible, harrow the orchard after rains in order to prevent the formation of a crust.

Although the season is advancing, good results may still be obtained from the application of manures, especially potash and nitrates. These fertilizers can either be spread round the trees or broadcast and harrowed in.

DISBUDDING, GRAFTS, ETC.

Trees planted during the winter months need attention as soon as they start into growth in the spring. Select three or four good well-placed shoots for the future framework of the tree, and suppress the remainder.

Examine grafts, loosening any ties where necessary to prevent damage as the scion grows. The old method of suppressing all shoots from the stock is now not advocated. Pinch back where necessary, leaving others in suitable positions for budding or grafting next season should any of the present grafts fail. If not required these can be pinched back later in the season. Where there is any danger of the new scions being broken off by wind it is advisable to protect them by tying to a stake attached to the branch grafted.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

With renewed activity of the trees, cultivation becomes the chief work in the citrus-grove. Where for any reason ploughing has not been done, but is now being attended to, the land should be worked down to a fine tilth as soon as possible after being broken up, it being a good practice not to turn up more than can be worked down during the same day. This is advisable owing to the risk of the turned-up clods becoming dry and so hard as to be almost unbreakable later.

In the case of land that has been previously ploughed periodical working with the cultivator should be done to secure a fine condition of the top soil as early in the season as possible. There is an impression current that because citrus-trees are so prone to make surface roots cultivation near the trees is inadvisable or even injurious. It is true that citrus-trees are all very prone to form a mass of fibrous roots near the surface, but it does not necessarily follow that these are of importance to the tree or should be encouraged. Rather the contrary applies; in fact, such roots should be discouraged, except where it is possible to apply a summer surface mulch of decayed manure or litter. Under a system of clean cultivation it is better to keep the surface soil constantly worked for at least 5 in. deep, thus preventing the formation of surface roots, and encouraging the roots at a lower level, where they are less susceptible to acute changes of temperature and moisture.

With a general extension of growth in the trees a limited amount of pruning should be done, mainly along the lines of preventing undue crowding or extension of new growth.

A soil-dressing of 1 lb. to 2 lb. of nitrate of soda, according to size of tree, should be given to oranges during or immediately after flowering. Application to lemons can be made later as they attain the fruit-set stage.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

LATE-HATCHED CHICKENS.

POULTRY-KEEPERS who have managed things well will have their full complement of chickens hatched out by the end of the present month. In a general way a chicken brought out later than this is starting its life under a big handicap as compared with the bird hatched earlier in the season. Some amends, however, may be made with late-hatched birds if they are placed under the most favourable conditions possible. The first essential is that they be provided with a clean piece of ground to run on, while shade from hot sun and shelter from winds are of equal importance. The food should not only be supplied with a liberal hand, but also be nourishing and palatable. Succulent green material cannot be oversupplied, while grit and clean water should always be within reach of the birds. Where skim-milk is available it can be given in large quantities to drink. The value of skim-milk for bringing on late-hatched chickens, or, indeed, chickens whenever hatched, can hardly be overstated. Further, if the young birds are to thrive and make rapid growth it is important that they be provided with clean quarters and protected from insect pests in every way.

AGE OF EGGS FOR INCUBATING.

A correspondent asks, If more or less stale eggs were placed in an incubator with fresh eggs, which of the two would hatch out first, and which would be the most likely to produce the strongest chicks? In a general way eggs that are from one to five days old will hatch out about the same time, and the quality of the chicks in all respects will be more or less equal. After this period the older the eggs become, the longer will it take to hatch them, and the smaller and more difficult will the chicks be to rear. It is quite possible to secure chicks from eggs that have been laid a month or even longer, but generally such eggs will take at least twenty-four hours longer to hatch than those that are fresh, while the chicks are seldom if ever good specimens. Usually the sooner eggs are placed under the incubation process after being laid the greater is the prospect that they will hatch out on time, and the stronger will be the chicks produced. Usually a good hatch is secured only when the eggs commence to pip on the twentieth day and hatch out twenty-four hours later.

The fact, however, of eggs not commencing to pip on the twentieth day does not necessarily indicate that they were stale when placed in the incubator. It is more often a proof that the required temperature has not been maintained. For hen or duck eggs the temperature at the level of the top of the eggs on the tray should be about 102° F. the first week, 130° the second and third weeks, and 104° when

hatching. When the correct degree of heat is spoken of it means the temperature required by the germ of the egg, and this is always located at the top of the egg, irrespective of the position in which it is resting, the germ always floating uppermost. The most common cause of eggs failing to hatch at the right time is placing the thermometer too high above them. Say the bulb of the thermometer is from 1 in. to 1½ in. above the eggs, it would require to register 104° to 105° to make sure of them having the desired temperature. Of course, an incorrect temperature may be secured by the reverse position—the thermometer being too far below the level of the top of the eggs.

If the thermometer is kept on a level with the germs, and the hatch delays, it is advisable to have the instrument tested or to secure a new one; it is quite common for thermometers not to register the correct degree of heat in an incubator. A simple method of testing is as follows: Place a clinical thermometer and the one to be tested in water at 100°; stir gently, adding hot water slowly at the same time, and observe the respective readings. If the incubator thermometer reads, say, a degree lower or higher than the clinical, it must be worked a degree higher or lower accordingly.

BROODY HENS.

Especially when the heavier breeds are kept, it will pay to visit the houses nightly and remove to the broody-coop any birds found on the nests. If a bird is removed from the nest on its first desire to sit it will usually lose this desire in two or three days, and will resume laying in a minimum of time; but if left on the nest for days it may be weeks before a normal egg-laying condition is regained. A broody-coop should be made in three compartments, one section being allowed for each day's broodies. Make the bottom of narrow battens fixed, say, 2 in. apart, and raise the coop on legs about 8 in. from the ground; also, unless placed under cover, make it watertight.

The coop should be so arranged that the birds can secure their food and water placed outside. A common but mistaken practice is to starve the broody hen. If egg-production is to be resumed in the shortest time possible, ample food, including meat, should be provided Cruel methods are sometimes resorted to in trying to stop hens from brooding, such as shutting them under a box for days without food and drink, or by holding their heads under water till they are almost drowned. Obviously, people who resort to such practices have not the love they should have for their fowls, and would be better employed at some other business than poultry-keeping.

ALLEGED INFERTILE EGGS.

Many poultry-keepers, particularly those who are working an incubator for the first time, fail to realize that eggs purchased for hatching purposes and which go rotten during the incubation process must have been fertilized, or they would not have gone bad. If an egg is unfertilized it will remain perfectly clear throughout the whole hatching-period. This is because there is no germ from which life can start. In despatching sittings of eggs the best a breeder can do is to send out only those which he has every reason to believe are fertile. Complaints relative to eggs failing to hatch are sometimes justified, but

in many cases the blame is placed on the wrong shoulders. Very often the person who makes the charge is more to blame for the failure than anybody else, through improper management of the incubator or the sitting hen, as the case may be. Again, eggs may be fertile but through rough handling in transit their hatching-qualities may be spoilt. Such eggs will often germinate, but will fail to live during the incubation period. They will certainly go rotten, as the process of the germ starting to germinate creates a gas which brings this condition about.

Even on the best-managed plants a proportion of infertile eggs may sometimes be sent out; but usually, and rightly so, if these are returned to a breeder he will gladly replace them. He cannot, however, be expected to replace alleged infertile eggs which prove, as a result of his own examination, to be actually fertilized. A case in point came under my notice the other day where a line of eggs which failed to hatch in an incubator was returned to a breeder and alleged to be infertile. On examination the greater part of the line was found to contain fully developed chicks, thus indicating that the failure was due to improper management of the incubator.

Where purchased eggs fail to hatch, much misunderstanding and annoyance would be avoided if trouble were taken to test them before being returned to a breeder, for the purpose of ascertaining whether or not they had been fertilized. Naturally, any breeder will resent being blamed for sending out infertile eggs which contain chicks in an advanced stage of incubation.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

ARTIFICIAL INCREASE.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer—if two or more are united, or if each one is reinforced by the addition of bees and brood from strong colonies—they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out

combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

SUPERING.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation, and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

CARE OF BEE-YARD.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE STRAWBERRY CROP AND OTHER SMALL-FRUITS.

THE strawberry crop will be ready for the pickers during the coming month, and arrangements for its distribution should be made now. This popular fruit requires expert handling to ensure it being delivered to the consumer while the berries have all their freshness and aroma. To do this the fruit must be gathered in the cool of the day when the plants are free of moisture. The stage of ripeness must depend on the distance they have to travel, but at the beginning of the season, when the weather is cool, they should be riper than later in the season, when they will ripen quicker in transit. If the pickers are properly instructed and supervised very little rehandling should be necessary. The berries should be picked with a short stem and placed in the punnets; these must be filled, and the top is required to be a fair sample of the fruit beneath. This is a legal requirement, and shipments packed in any other way are liable to bring trouble on the seller. Overripe, misshapen, and undersized berries should be picked and placed in a separate container and sold for culinary purposes. Keep all punnets and crates clean, as this will add very much to the appearance and value of the pack. The berries at all times must be kept in a shaded cool place that is free from dust. Gritty and rain-splashed berries are of no value, so the mulch of straw or rushes should be laid in good time to avoid that danger.

Culinary gooseberries will also soon be ready for gathering. They should be marketed promptly, before the early stone-fruit commences to come on the market Culinary fruit is in short supply at this season, and gooseberries are useful in supplying it during this interval.

Raspberry and loganberry plantings now require light cultivation in fine weather to destroy weeds and conserve moisture. Apply nitrogenous fertilizers as necessary to induce satisfactory growth, and remove unnecessary sucker growths in the alleys.

TOMATOES.

The outdoor tomato crop will now be getting established. Cultivation should be shallow, so as to avoid disturbing the roots, as, like most fruiting plants, tomatoes do best in a well-compacted soil. Tying and suckering will require prompt attention in order to prevent the plants making unnecessary growth and thus delaying the early crop. Keep a sharp lookout for any sign of disease, and fill all gaps as soon as they occur with specially prepared plants.

The tomato crop under glass will now commence to ripen, and where the subsoil is inclined to be dry a mulch of stable litter should be laid. Trim off the leaves that shade the bottom bunch, and feed the plants judiciously at short intervals. Keep the plants rather on the warm side, as a chill now will cause delayed ripening. Should any sign of black-stripe disease appear, the plants should be given a dressing of potash fertilizer without delay.

TOBACCO-GROWING.

The earlier plantings of tobacco will now be established in the field. There should be very few gaps in the rows if the plants were well

selected and carefully placed. Any replacements should be made promptly with specially selected plants, as otherwise such replacements are backward and cause more work than they are worth. Hoeing and cultivation may now be done with horse-drawn implements, and, if regularly attended to, the plants will benefit, and very little hand cultivation and hoeing will be required later when the danger of damaging the leaf makes cultivation with horses impracticable. The sooner planting is completed the better, for reasons previously stated in these notes.

VEGETABLES.

With the completion of the planting of the half-hardy crops previously mentioned, the work now chiefly consists in thinning, hoeing, and feeding the growing crops. Where seeds of known germination have been sown thinly, the tiresome task of thinning will take little time; but whatever work of this kind is required it should be done early, or growth is delayed and the plants suffer seriously. If fine bright weather is chosen for hoeing and cultivation, the best and quickest results are obtained. Judicious feeding with fertilizers from time to time requires experience and close attention, but much can be accomplished by such means.

Where winter crops are to follow the early the latter should be lifted promptly, so that the heavy dressings of manure the winter crops require may be given and the land allowed to settle into a firm bed ready for planting about the end of the year. These winter crops—now in the seed-beds—are very subject to insect enemies, but the application of a spray compound of arsenate of lead and tobacco concentrate administered at intervals of a fortnight, when necessary, is the most effective remedy we have.

NATIVE TREES AND SHRUBS.

The art of effective planting of trees and shrubs is acquired only by observation at all seasons of the year. From notes thus made the planter is prepared in the autumn to make out a satisfactory order for his requirements of trees and shrubs. The brilliant display this spring of both yellow and red kowhai, the shining mantles of clematis hanging in the higher trees, and plumes of well-grown rangiora, when seen together quite refute the charge of the dullness of our native groves one so often hears. The red kowhai (kowhai-ngutū-kaka of the Maori) is rare in the bush, and is found in very few places outside some of the islands of the Auckland District. It is known botanically as *Clianthus puniceus*, and among the many seedlings grown there are a few with blossoms of very large size and rare shades of colour. These plants—and most others are most effective when planted in rather large groups in a suitable environment. They should certainly receive more attention from those who make a feature of native plants in their gardens.

—*W. C. Hyde, Horticulturist, Wellington.*

Exportation of Stud Stock.—During the official year 1926–27 the stud stock exported from New Zealand consisted of 5,327 sheep, 57 cattle, 16 horses, and 5 pigs.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SCABS ON COWS' TEATS.

"DAIRYMAN," Kiwitahi Railway :—

I should be much obliged if you could advise me how to treat and cure "black-scab" (as we call it) on cows' teats. Also, is it contagious? I have seen it on cows once or twice in previous seasons, but was unable to cure it, though trying all kinds of ointments and disinfectants. This year I have two cows affected. The trouble begins with just a small round scab on the teat, which rapidly gets larger, and the whole teat becomes hard and inflamed, making it almost impossible to get the milk from the quarters. In one case the inflammation has gone down but the scab is obstinate.

The Live-stock Division :—

The probable commencement of these scabs on cows' teats is the ordinary cow-pox lesion, which, owing to the friction inevitable during the milking process, has burst and become infected with other germs, thus making a sore which is very obstinate to heal. The teats should be washed in warm soda water to soften the scabs, and then the sores should be regularly dressed with a preparation made by mixing equal parts of zinc ointment and boracic ointment. When milking affected teats this ointment should be freely used in order to keep the part soft, the milk being given to calves or pigs. This disease may be carried from cow to cow by milkers' hands or by teat-cups. Therefore affected cows should be milked last, and all possible sources of infection eliminated by washing the hands or by dipping the cups in boiling water after milking each affected cow.

WHITEWASHES FOR MILKING-SHED.

"SUBSCRIBER," Nireaha :—

I should be obliged if you would give me a recipe for making a whitewash suitable for milking-sheds.

The Dairy Division :—

Three recipes are appended. No. 2 is an outdoor whitewash, and if well made will withstand rain for years. No. 3 is the best for woodwork.

(1) One sack of rock lime, 8 lb. mutton-fat, 10 gallons butcher's brine. In watertight tub put the lime and fat in alternate layers, add hot water to cover this, and let stand twenty-four hours with sack over tub. Add 10 gallons of butcher's brine, and stir. Put through a fine sieve, and add water if too thick for use. If cream colour is required, add to the mixture 5 lb. green copperas dissolved in hot water.

(2) In a tub put 2 gallons of pulverized unslaked lime and plenty of water to slake it. Stir in about ½ lb. of tallow or other grease, and mix well. Then add hot water enough for use.

(3) In a tub put 45 lb. pulverized unslaked lime, and slake by pouring over it boiling water sufficient to cover 4 in. or 5 in. deep, stirring until quite slaked. Dissolve in water, and add 2 lb. sulphate of zinc and 1 lb. common salt, which will cause the wash to harden on woodwork. Add sufficient water to make workable. To make cream colour, add 3 lb. yellow ochre; fawn colour, 4 lb. umber, 1 lb. Indian red, and 1 lb. lampblack; grey or stone colour, 4 lb. umber, 2 lb. lampblack.

FEEDING-VALUE OF THRESHED CRESTED-DOGSTAIL HAY.

O. W. GREEN, South Makirikiri :—

Kindly inform me as to the feeding-value, as feed for milking-cows, of crested-dogstail hay having been through the threshing-mill.

The Fields Division :—

The feeding-value will greatly depend on the condition of the crested-dogstail straw. If it was saved in good order and is still bright it should be a very useful fodder to feed in conjunction with roots or other green material, and for this purpose should be worth about half as much as good meadow hay. If, on the other hand, no roots or green material are available it would not be so valuable. The grass would naturally be dry for threshing, and this would prevent the cows digesting large quantities; and if they were overfed on it they could not be expected to milk well.

SORGHUM AND COWS.

"INQUIRER," Leigh :—

Please inform me whether sorghum at any stage of its growth will cause abortion in cows when eaten.

The Live-stock Division :—

It may be taken that abortion among cows is almost always caused by the specific organism or bacillus, and that, broadly speaking, feed has little to do with the slipping of calves. While this fact is recognized, cows may abort owing to a severe general disturbance of the system such as obtains in some acute infectious diseases, or perhaps in acute indigestion accompanied by excessive tympany or bloat. Sorghum belongs to the cyanogenetic group of plants, and there is some danger that the immature material or second growth after cutting may cause prussic-acid poisoning. If a cow became poisoned by feeding on immature sorghum, it is possible that her system might be so upset that the calf would be expelled prematurely; but as long as she remained apparently normal she would not abort as a direct result of eating sorghum. Sorghum should be allowed to ripen, or cut and allowed to wither, before being fed to cows.

FEEDING OF CALVES AND PIGS.

"INQUIRER," Whakaangiangi :—

Should oats be used crushed or whole for calves, and how much should a calf receive? Should barley be soaked in hot water before giving to pigs, and how much should a weaner receive? Will maize do for young pigs instead of barley? I can buy it for 6s. or 7s. a sack in the cob, which is equal to about 16s. or 18s. a sack shelled, and barley costs about 6s. a sack in freight, besides the first cost of the grain.

The Live-stock Division :—

It is advisable to feed calves on crushed oats rather than whole oats. Start with a handful, increasing up to ½ lb. daily when five months old. As regards the question of feeding soaked barley to pigs, it would depend largely on the number of pigs being fed and the facilities for procuring the hot water. Experiment does not show any increased benefit from soaking or boiling barley before feeding. The greatest benefit is derived from barley when fed as meal. As to the quantity to feed, a weaner can with safety consume up to 1 lb. per day for each month of age. The quantity will depend on what other food is being used. If this is separated milk, allow, say, 7 lb. milk to represent 1 lb. barley. That means that an eight-weeks weaner will receive 7 lb. separated milk and 1 lb. barley, or 1 gallon milk and ½ lb. barley, if intended for pork. If for bacon, feed at the rate of 1 lb. of grain or substitute for every month of age, less one month after the fourth month. In other words, a five-months pig will receive 4 lb. of grain or substitute per day. For young pigs maize may be substituted for barley, but is not so good. In your case, however, cost appears to justify its use. Maize does not give as fine a finished product in quality and colour as barley.

Noxious-weed Order.—The Masterton County Council has declared hemlock (*Conium maculatum*) to be a noxious weed within that county.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1927.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago (including Southland).	Total in Dominion.
Stud rams (entered in flock-books)	1,093	1,052	3,806	865	2,877	2,641	12,334
Other rams	32,983	94,473	77,422	20,221	78,422	72,419	375,940
Wethers	363,750	636,681	658,474	236,774	510,719	668,576	3,074,974
Breeding-ewes	1,251,412	3,612,142	3,041,878	730,030	3,237,513	2,958,749	14,831,730
Dry ewes	70,440	268,059	175,416	47,824	141,006	128,946	831,691
Lambs	569,810	1,705,477	1,393,452	333,928	1,131,874	1,387,806	6,522,347
Totals, 1927	2,289,488	6,317,884	5,350,448	1,369,648	5,102,411	5,219,137	25,649,016
Totals, 1926	2,244,603	6,236,211	5,349,436	1,353,075	4,971,322	4,750,346	24,904,993

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1918–27.

Year.	Stud and Flock Rams.	Stud Breeding-ewes.	Stud Dry Ewes.	Stud Lambs.	Total Stud Sheep and Flock Rams.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.
						Wethers.	Breeding-ewes.	Dry Ewes.	Lambs.	
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	12,850,597	1,592,452	7,770,772	26,538,302
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	12,176,224	1,799,201	7,304,171	25,828,554
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	11,415,159	1,814,391	6,208,284	23,919,970
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	11,989,180	1,336,306	5,724,053	23,285,031
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	12,341,777	952,789	5,618,240	22,222,259
1923	330,055	172,843	9,013	119,749	631,660	2,551,627	12,890,160	808,919	6,199,073	23,081,439
1924	332,814	179,533	9,727	132,137	654 211	2,807,832	12,896,561	1,036,723	6,381,249	23,775,776
1925	355,579	184,744	7 867	131,485	679,675	3,063,663	13,530,479	875,899	6,398,239	24,547,955
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	13,756,197	1,069,682	6,155,510	24,904,993
1927	388,274	199,219	8,614	144,897	741,034	3,074,974	14,632,511	823,047	6,377,450	25,649,016

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1927).

Breed	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-books)—									
Merino	..	..	15	15	9,682	14,284	5,990	29,956	29,971
Lincoln	432	2,100	6,674	9,206	506	129	679	1,314	10,520
Romney	18,015	15,272	78,715	112,002	10,630	4,819	36,895	52,344	164,346
Border Leicester	430	..	710	1,140	410	11,007	11,854	23,271	24,411
English Leicester	855	576	160	1,591	1,205	17,294	312	18,811	20,402
Shropshire	363	..	586	949	60	2,885	940	3,885	4,834
Southdown	2,839	7,467	26,324	36,630	963	14,950	1,507	17,420	54,050
Corriedale	456	271	1,157	1,884	909	36,707	10,341	47,957	49,841
Ryeland	587	539	547	1,673	84	1,470	127	1,681	3,354
Other breeds	39	..	99	138	1,347	1,739	141	3,227	3,365
Totals	24,016	26,225	114,987	165,228	25,796	105,284	68,786	199,866	365,094
Sheep of a distinctive breed but not entered in flock-books—									
Merino	7,990	24,620	22,969	55,579	215,819	432,524	301,885	950,228	1,005,807
Lincoln	10,035	23,209	23,377	56,621	3,483	5,881	18,497	27,861	84,482
Romney	333,214	1,500,839	1,047,305	2,881,358	125,399	79,481	224,731	429,611	3,310,969
Border Leicester	4,043	1,432	1,380	6,855	3,270	25,220	34,060	62,550	69,405
English Leicester	3,794	1,684	501	5,979	7,510	37,569	4,352	49,431	55,410
Shropshire	5,614	273	1,245	7,132	1,395	5,841	3,187	10,423	17,555
Southdown	6,377	20,851	52,608	79,836	869	14,082	1,315	16,266	96,102
Corriedale	3,860	1,081	30,719	35,660	23,216	510,304	317,127	850,647	886,307
Half-breds	3,488	657	12,699	16,844	253,817	691,222	267,463	1,212,502	1,229,346
Ryeland	244	378	197	819	49	921	99	1,069	1,888
Other breeds	481	624	395	1,500	99	270	573	942	2,442
Totals	379,140	1,575,648	1,193,395	3,148,183	634,926	1,803,315	1,173,289	3,611,530	6,759,713
Crossbreds and others not otherwise enumerated	1,886,332	4,716,011	4,042,066	10,644,409	708,926	3,193,812	3,977,062	7,879,800	18,524,209
Grand totals	2,289,488	6,317,884	5,350,448	13,957,820	1,369,648	5,102,411	5,219,137	11,691,196	25,649,016

WEATHER RECORDS: SEPTEMBER, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows:—

The total rainfall of the month was above normal over the North Island, except at places in the central region and between Wanganui and Wellington. In the South Island, Otago had more than the average, and Blenheim also reported an excess, but elsewhere there was a deficiency. The greatest differences from the mean are shown on the eastern coasts, Gisborne having 76 per cent. above and Christchurch 73 per cent. below.

There were no general heavy rains during the month, but several occasions on which heavy local falls occurred. For instance, on the 5th and 6th very heavy rain was experienced in Otago, the effect of a low centre passing in that region. Floods resulted in some of the rivers, and much of the low-lying country was under water at this time. On the 27th and 28th a cyclone centred off East Cape brought heavy rain to the Gisborne and Hawke's Bay districts. The most generally unsettled period was between the 17th and 27th. Dull, misty, and showery conditions prevailed, and on the 25th some snow fell in the South Island in the rear of an intense Antarctic disturbance. Anticyclonic conditions with fair weather ruled in the beginning, from the 13th to the 17th, and at the close of the month.

Although dull weather was frequent there were no severe cold periods, and, from observers' remarks, conditions appear to have been favourable for lambing, and the month generally was a good growing one.

RAINFALL FOR SEPTEMBER, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	5·72	17	1·06	4·75
Russell	4·47	13	1·11	4·66
Whangarei	5·97	18	1·62	5·03
Auckland	4·31	21	1·04	3·65
Hamilton	3·83	17	0·88	4·40
Kawhia	6·68	23	1·16	4·39
New Plymouth	5·43	15	1·26	5·27
Riversdale, Inglewood	8·76	15	2·25	9·48
Eltham	4·05	15	0·72	3·91
Whangamomona	4·63	11	0·96	7·57
Tairua	5·28	15	2·28	4·64
Tauranga	4·80	15	1·00	4·41
Maraehako Station, Opotiki ..	4·80	14	1·38	4·18
Gisborne	5·31	12	2·26	3·01
Taupo	3·05	9	0·83	3·71
Napier	3·46	13	1·80	2·19
Maraekakaho Station, Hastings ..	2·96	18	1·37	2·58
Taihape	1·45	17	0·26	3·44
Masterton	1·06	11	0·22	3·13
Patea	2·69	13	0·60	3·63
Wanganui	1·37	8	0·39	2·96
Foxton	2·20	10	0·50	2·43
Wellington	3·07	16	1·23	3·99
South Island.				
Westport	6·50	17	1·58	6·82
Greymouth	5·25	17	1·54	7·96
Hokitika	7·54	16	1·59	9·33
Ross	8·91	12	1·71	13·06
Arthur's Pass	7·35	11	1·56	15·50
Collingwood	8·54	12	1·51	10·13

RAINFALL FOR SEPTEMBER, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	3·75	9	1·10	3·75
Spring Creek, Blenheim ..	3·31	11	0·88	2·69
Tophouse	5·33	12	1·20	5·47
Hanmer Springs	1·56	11	0·62	4·20
Highfield, Waiau	1·42	7	0·58	3·12
Gore Bay	1·27	9	0·34	3·31
Christchurch	0·48	8	0·20	1·79
Timaru	1·56	10	0·50	2·07
Lambrook Station, Fairlie ..	1·70	6	0·86	2·21
Benmore Station, Clearburn ..	1·60	8	0·68	2·14
Oamaru	1·93	8	0·78	1·69
Queenstown	1·58	8	0·75	2·47
Clyde	1·73	6	0·49	1·06
Dunedin	4·90	11	2·25	2·74
Wendon	5·54	8	2·35	2·12
Gore	4·42	13	1·33	2·52
Invercargill	3·89	20	1·48	3·11
Puysegur Point	8·36	19	2·34	5·53

MAMMITIS IN DAIRY HERDS.

THIS subject is dealt with by the Director-General of Agriculture in his annual report for 1926–27, as follows:—

Mammitis is reported as having been less prevalent during the year, but plenty of cases still occur and much loss is caused. In order to combat mammitis there is no doubt that careful management of the herd and constant care in watching for and detecting cases in their early stage are necessary. The udder of the cow is a most delicately constructed organ, highly susceptible to any influences which will cause irritation or disturbance of its normal functions, and this is especially the case when the animal is in full milk. The very general use of milking-machines accentuates the necessity for the exercise of the greatest care. Owing to the conditions existing here milking-machines have become a practical necessity, and they are undoubtedly a valuable adjunct to the dairy farm, but if carelessly handled, or if kept in an uncleanly condition, they may do much harm, and the necessity for the exercise of every care in regard to them cannot be too strongly emphasized. With hand milking the presence of any inflammatory condition of the udder can be quickly noted while the trouble is in its early stages, but with the machine it may easily be overlooked until it has become severe, by which time contagion, if it be present, may have spread to other cows in the herd. Again, driving a machine at too high pressure is calculated to produce udder trouble, as also is omission to remove the machine-cups immediately the udder has been milked out. Dirt is also bad, whether in the machine parts or in the shed or its immediate surroundings. Apart from trouble arising from this cause, however, contagious mammitis not infrequently occurs among hand-milked cows, and it needs to be consistently guarded against. The departmental field officers are always willing to advise dairy-farmers both as to preventive and remedial treatment, and their services are largely called upon.

At the Wallaceville Laboratory steady research work is going on, and some interesting experiments have been carried out, these including the use in herds of a vaccine (known as an autogenous vaccine) prepared from the milk of a cow in the herd suffering from contagious mammitis. A range of results sufficiently wide to enable any reasonably definite conclusion to be arrived at has not yet been reached, but the work is going on, and it may open up a line of effort towards a method involving less time and trouble in application.

Reports have been received from Stock Inspectors throughout the Dominion regarding the results of the use of proprietary preventive vaccines for mammitis. These embody varying opinions from farmers on whose herds the vaccines have been tried; but the balance of opinion is against their efficacy.

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates have been notified by agricultural and pastoral associations:—

Hawke's Bay A. and P. Society: Tomoana, 19th and 20th October, 1927.
Poverty Bay A. and P. Association: Gisborne, 25th and 26th October.
Wairarapa A. and P. Society: Carterton, 26th and 27th October.
Marlborough A. and P. Association: Blenheim, 26th and 27th October.
Timaru A. and P. Association: Timaru, 26th and 27th October.
Manawatu A. and P. Association: Palmerston North, 1st, 2nd, and 3rd November.
Kelso A. and P. Association: Kelso, 2nd November.
Northern A. and P. Association: Rangiora, 4th November.
Wanganui A. and P. Association: Wanganui, 9th and 10th November.
Canterbury A. and P. Association: **Royal Show,** Christchurch, 9th, 10th, and 11th November.
Waimate A. and P. Association: Waimate, 15th November.
Egmont A. and P. Association: Hawera, 16th and 17th November.
North Otago A. and P. Association: Oamaru, 17th and 18th November.
Otago A. and P. Society: Dunedin, 23rd and 24th November.
Stratford A. and P. Association: Stratford, 23rd and 24th November.
Tokomairiro Farmers' Club: Milton, 28th November.
Clutha and Matau A. and P. Society: Balclutha, 1st and 2nd December.
Auckland Metropolitan A. and P. Association: Auckland, 2nd and 3rd December.
Wyndham A. and P. Association: Wyndham, 9th December.
Otago Peninsula A. and P. Society: 10th December.
Nuhaka A. and P. Association: Nuhaka, 1st January, 1928.
Marton District A. and P. Association: Marton, 18th January.
Waipukurau A. and P. Association: Waipukurau, 20th January.
Horowhenua A. and P. Association: Levin, 24th and 25th January.
Tapanui Farmers' Club: Tapanui, 25th January.
Rangitikei A. and P. Association: Taihape, 25th and 26th January.
Helensville A. and P. Association: Helensville, 30th January.
Golden Bay A. and P. Association: Motupipi, 1st February.
Woodville A. and P. Association: Woodville, 3rd and 4th February.
Omaha and Pakiri A. and H. Association: Leigh, 4th February.
Clevedon A. and P. Association: Clevedon, 4th February.
Feilding A. and P. Association: Feilding, 7th and 8th February.
Dannevirke A. and P. Association: Dannevirke, 8th, 9th, and 10th February.
Hikurangi-Otonga A. and P. Association: Hikurangi, 9th February.
Masterton A. and P. Association: Solway, 14th and 15th February.
Te Awamutu A. and P. Association: Te Awamutu, 15th February.
Taumarunui A. and P. Association: Taumarunui, 15th February.
Ohura A. and P. Association: Matiere, 22nd and 23rd February.
Franklin A. and P. Association: Pukekohe, 24th and 25th February.
Tauranga A. and P. Association: Tauranga, 29th February.
Hukerenui Agricultural Association: Hukerenui, 1st March.
Mongonui County A. and P. Association: Kaitaia, 3rd March.
Opotiki A. and P. Association: Opotiki, 6th March.
Taranaki Agricultural Society: New Plymouth, 7th and 8th March.
Matamata A. and P. Association: Matamata, 13th March.
Kaikoura A. and P. Association: Kaikoura, 16th March.
Mayfield A. and P. Association: Mayfield, 17th March.
Hawarden A. and P. Association: Hawarden, 23rd March.
Methven A. and P. Association: Methven, 29th March.
Oxford A. and P. Association: Oxford, 5th April.

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THE GUM-TREE WEEVIL AND ITS PARASITES.

PRELIMINARY CONTROL WORK IN NEW ZEALAND.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

OF recent years the Australian gum-tree weevil (*Gonipterus scutellatus*) has become of major importance as a pest of Eucalyptus in many parts of New Zealand and South Africa. The position became so acute that some time ago the writer and Mr. C. P. Lounsbury, then Chief of Division of Entomology, Pretoria, entered into co-operation with a view to securing for shipment to Africa and New Zealand parasites of the weevil from Australia. As nothing was then known of the weevil and its parasites in Australia, an attempt was first made to secure the services of a Commonwealth entomologist to undertake the search for the required parasites. However, no one being available in Australia, Mr. Lounsbury decided to take up the work, and Mr. F. C. Tooke, of his Division, has been stationed in South Australia for some time past.

Mr. Tooke's mission has proved remarkably successful in that he not only located parasites of the pest but also successfully made shipments to South Africa. Through the kindness of Mr. Lounsbury he also sent a consignment of parasites to the writer for establishment in New Zealand. It is understood that a full account of the work in Australia and South Africa, and also of the parasites, will be published by the Union entomologists; the present article is merely a record of the position as regards New Zealand.

LIFE-HISTORY OF THE WEEVIL.

During winter the adult beetles (Fig. 1) collect in large numbers under the loose bark on the bole of eucalypts, especially those of blue-gums (*E. globulus*), where the best shelter is to be found. The hibernating period of the beetle is from May to August (inclusive), and in some localities is prolonged into September. After hibernation the beetles migrate to the young foliage and there lay their eggs. It is especially noticeable that these spring eggs are most abundant on blue-gum, due no doubt to the fact that this species, by affording the

best winter quarters, is most heavily populated by the weevils in spring. Later the beetles migrate to other species of eucalypts, where the eggs of the second generation abound, being especially abundant on *E. viminalis*.

Egg-laying continues for several weeks in the spring, and does not cease until November. The eggs are laid in small blackish cases

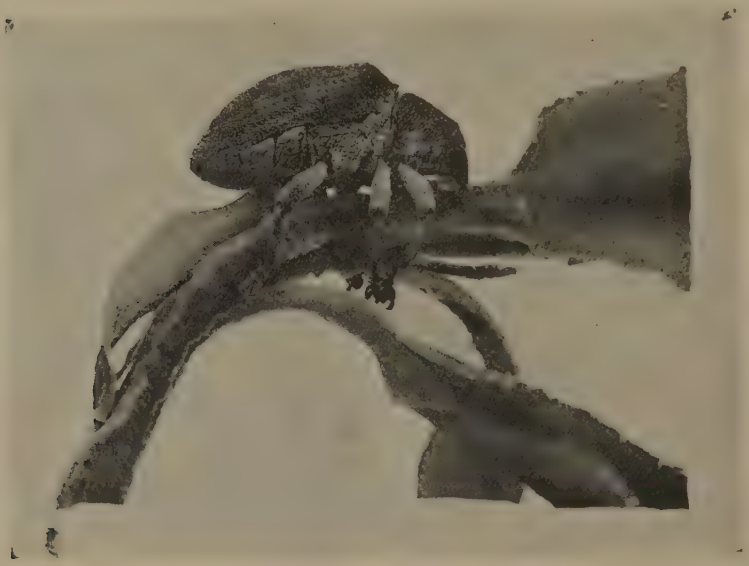

FIG. 1. WEEVIL ATTACKING LEAF. × 6.

FIG. 2. EGG-CASE OF WEEVIL ON LEAF. × 5.

(Fig. 2), each of which contains a varying number (as many as a dozen) and is attached to the young leaves. The newly hatched larvæ emerge from the egg-cases by eating their way through the leaf, so that the cases appear intact even after all the larvæ have left them.

The legless larvæ, which attack the surface of the foliage, eating narrow slits therefrom (Fig. 3), are at first yellowish, darkly striped along the sides, and studded with small black dots (Fig. 4): the mature larvæ become yellowish-green, and slug-like in general appearance (Fig. 5). The larval period on an average extends over four or five weeks, when the larvæ leave the trees, enter the ground, and pupate. The duration of the pupal period is three or four weeks,

FIG. 3. LEAVES DAMAGED BY WEEVIL AND ITS LARVÆ.

and the complete cycle, from the laying of the eggs to emergence of the weevils, extends from eight to twelve weeks.

In December and January the second or summer brood of weevils is in abundance, and the insects are then found on most species of Eucalyptus, but more specially on *globulus* and *viminalis*. Egg-laying again takes place, and by March and April the larvæ (second or summer generation) have again left the trees to pupate in the ground. During this period, also, the hibernating weevils commence to become abundant and migrate to their winter quarters on the blue-gum.

In the main there are two generations each year, the autumn (hibernating) and the summer generations.

NATURE OF DAMAGE BY WEEVIL.

The gum-tree weevil causes damage to eucalypts both as larva and adult, the former eating from the surface of the foliage, and the latter not only devouring the margin of foliage but also eating down

FIG. 4. YOUNG WEEVIL LARVA ON LEAF. × 5.

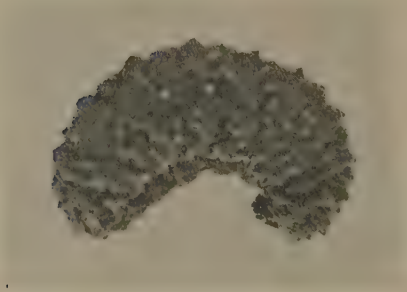

FIG. 5. ADULT WEEVIL LARVA. × 6.

tender shoots and epidermis from older ones. The infestation is frequently so severe that the trees become stunted. *E. globulus* and *E. viminalis* are the most severely attacked species. The autumn

brood of weevils also does some damage to growing apples, principally attacking the stalk, but often the epidermis.

THE PARASITES.

Among the parasites discovered in Australia by Mr. Tooke is a species of mymarid (Fig. 6) that parasitizes the eggs of the weevil. On 20th October (last month) a consignment of parasitized weevil-eggs sent by Mr. Tooke was received by the writer. These eggs were shipped in glass tubes, the leaf to which each egg-case was attached having been trimmed down and a pin driven through it; a number of egg-cases were thus pinned on a slip of cardboard in each tube. A total of 220 egg-capsules was in this consignment.

On arrival a considerable number (approximately 200) of mymarids had emerged and were dead, but numbers were still emerging. The latter were removed and placed in smaller tubes containing local eggs, three parasites on an average being enclosed with from twelve to eighteen egg-cases. Though on examination all these parasites seemed to be the one species, it was considered advisable to ascertain this definitely. In a number of tubes, each containing six egg-cases, a single parasite was placed, and if it is found that the mymarid emerges from these, that material will be used in the first field liberations.

In almost all cases, as soon as placed with the local egg-capsules, the parasites commenced to oviposit in the weevil-eggs (Fig. 7), and there is every prospect of the successful establishment of this parasite. Though no hyperparasites have been noted in Australia, or from the material sent to Africa, a chalcid had developed from the material sent to New Zealand, and this insect has been segregated in order to ascertain its relationship, if any, with the mymarid.

The following is the record of parasite emergences from the Australian consignment up to date of writing (2nd November):—

Emergence Date.	Parasite.		Emergence Date.	Parasite.	
	Mymarid.	Chalcid.		Mymarid.	Chalcid.
Oct. 20 ..	22	..	Oct. 28 ..	25	1
,, 21 ..	51	..	,, 29 ..	8	3
,, 22 ..	41	..	,, 30 ..	..	2
,, 23 ..	5	..	,, 31 ..	4	3
,, 24 ..	4	..	Nov. 1 ..	..	3
,, 25 ..	6	..	,, 2 ..	..	6
,, 27 ..	24	..			
			Totals ..	190	18

As far as the observations have gone the percentage of mymarid parasitism in the Australian material is not very high, considering that a total of 390 mymarids (including the 200 found dead on arrival) has emerged from 220 egg-cases, each of which contains several eggs. Under New Zealand conditions, however, and free of natural controlling influences there is every possibility of this mymarid successfully controlling the weevil in the Dominion. A feature in the foregoing

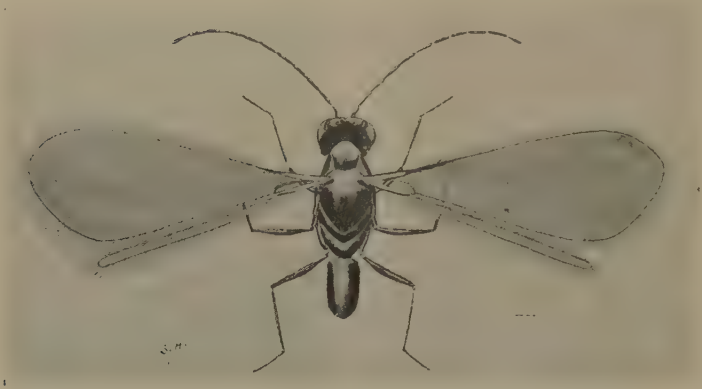

FIG. 6. MYMARID PARASITIC ON EGGS OF WEEVIL.
Natural size shown by the small line on right below wings.

(*a*)

(*b*)

FIG. 7. MYMARID OVIPOSITING IN WEEVIL EGG-CASE.
(*a*) Placing ovipositor in position; (*b*) ovipositor driven home. Natural size shown by small facsimile on right of each drawing.

table, showing a possible relationship between mymarid and chalcid, is that as the former decreases the latter increases.

We are greatly indebted to Mr. C. P. Lounsbury and Mr. F. C. Tooke for their generous aid towards the parasitic control of the gum-tree weevil in New Zealand. The accompanying drawings of the mymarid parasite (Figs. 6 and 7) are the work of Miss S. Hudson, of the Biological Laboratory staff.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR YEARS 1926 AND 1927.

F. J. A. BROGAN, M.Sc., Analyst, Chemistry Section, Wellington.

II.—QUALITY OF FLOURS.

THE milling-qualities of a number of wheats from the 1926 and 1927 harvests were summarized in the *Journal* for September last. The quality of the flours obtained, as indicated by chemical analysis, is discussed in the present article.

It should be borne in mind that no system of chemical analysis yet devised can give conclusive evidence as to the behaviour of a flour on being made into bread; but, apart from this consideration, the information obtained is of assistance to the baker in indicating the best method of handling the flour in the bakery. The various chemical tests usually performed, and their relative significance, have been described in previous *Journal* articles, but for the convenience of the reader a brief *résumé* is here given.

PROTEIN.

Opinion is divided on the question of which chemical constituent of flour is most closely connected with strength. The crude protein content is perhaps most in favour, followed by the quantity and quality of the gluten. As the greater part of the protein substance of wheat is contained in the gluten, the quantity of gluten in a flour must be a guide to its strength or power to produce a loaf of good volume and texture. If a flour containing a good amount of gluten fails to make a good loaf the physical structure or quality of the gluten must be at fault. The method of arriving at an estimate of the quality of gluten is given below.

GLUTEN.

The method of estimating gluten consists in making the flour into a dough, and then washing away the starch and soluble matter under a stream of water. The temperature and rate of flow of the water and length of washing must be carefully controlled if concordant results are to be obtained. The personal factor leads to discrepancies in the results from different operators, but each operator gets essentially consistent results. The ratio of wet to dry gluten gives an indication

of the probable behaviour of the dough. A ratio of from 3·0 to 1 to 3·1 to 1 indicates a flour of good strength as a rule. If the ratio is much above this the dough will not stand up well on fermentation; and if much below 2·9 to 1 the gluten becomes tough and requires strong fermentation to give good results. The quality of the gluten is determined by an inspection of its elasticity, colour, and cohesion. Gluten of low quality is greyish in colour, sticky, and of poor elasticity.

MOISTURE AND ASH.

The moisture content of New Zealand flours varies within narrow limits, and calls for no special comment. The amount of water absorbed by a given weight of flour in order to produce a dough of good consistency is, of course, influenced by the moisture content. The percentage of ash is a guide to the grade of the flour, and thus to the completeness of the milling operations, but due consideration must be given to the variety of wheat from which it is obtained. Durum or macaroni wheats have a very high ash content, yet the flour is of good strength, and with proper treatment is capable of producing bread of good quality. The ash of a straight grade flour usually varies from 0·54 to 0·61 per cent. A glance at the accompanying tables will show that the average figure for the flours examined is rather higher than this.

COLOUR OF FLOUR.

The colour of flour depends chiefly on two factors. There is, first, the effect due to carotin, the natural yellow pigment of flour, and, second, the effect due to minute particles of bran, which contain a reddish-brown pigment. The yellow pigment is removed by bleaching, while the other is not. The Pékar test, which is usually employed by millers, was used in the work here recorded. It consists in wetting compressed wedges of the flour to be compared, placed side by side, and drying in the steam-oven. The colour of the flour becomes darker owing to oxidation, and comparison is more readily effected. A light-cream colour is considered most satisfactory. Dead white indicates excess of starch and gluten of poor quality, while the appearance of a brown tint reveals the presence of bran particles. Kent Jones (2) has recently devised a method of obtaining a numerical expression for the colour of flour. The yellow and reddish-brown pigments are separately extracted by different solvents, and the colours compared with solutions of standard tints. The grade of the flour may be judged by the amount of reddish-brown pigment present, which presumably comes from the finely-powdered offal. No correlation was observed by the present writer between the colour of the flour and that of the gluten.

Notes on the Tabulated Results.

1926 Series (Table 3).

A sample of College Hunter's wheat (W 257) contained the highest amount of protein in this series, comparing favourably with previously recorded figures; the gluten, present in good quantity, was also of good quality; the ash content was somewhat high, and the colour of the flour rather poor. Another sample (W 152), from Ashburton, contained much less protein, but the quality of the gluten appeared

Table 3.—Chemical Analyses, 1926 Harvest Wheats.

Laboratory No.	Variety.	Locality where grown.	Calculated Weight per Bushel.	Flour.	Moisture.	Absorption of Water.	Gluten, Wet.	Gluten, Dry.	Ratio of Wet to Dry Gluten.	Protein (N. × 6·25).	Ash.	Colour of Experimental Flour.	Quality of Gluten by Appearance.
W			lb.	PerCent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	PerCent.		
257	College Hunter's ..	Horrelville ..	63	74·4	13·21	50·0	40·11	12·37	3·24	11·25	0·69	Poor ..	Good.
168	Jumbuck ..	,, ..	64	75·3	13·01	53·0	33·40	11·17	3·00	11·06	0·63	Fair ..	Rather poor.
171	White-straw Tuscan	,, ..	64	75·7	13·84	48·4	40·19	11·95	3·36	10·88	0·54	,, ..	Good.
154	Jumbuck ..	Ashburton ..	61	73·6	13·38	53·4	33·94	11·49	2·95	10·75	0·72	Good ..	Poor.
169	Red Fife ..	Horrelville ..	66	71·2	12·57	50·4	33·69	10·78	3·12	9·88	0·57	Fair ..	Good.
166	Marquis ..	Ashburton ..	65	73·4	12·95	51·0	32·38	10·24	3·16	9·63	0·76	Poor ..	,,
259	Quality White ..	Methven ..	64	73·4	13·10	50·4	33·61	10·44	3·22	9·44	0·64	Fair ..	,,
172	Goldberry (Hybrid W)	Horrelville ..	64	75·2	13·35	49·4	29·74	9·15	3·25	9·25	0·60	,, ..	,,
170	Queen Fair ..	,, ..	65	72·8	13·48	48·0	32·27	9·93	3·25	9·00	0·56	,, ..	,,
256	Yandilla King ..	,, ..	60	74·0	13·68	50·6	28·69	8·89	3·23	8·88	0·66	,, ..	Fair.
155	Red Fife ..	Ashburton ..	61	72·7	13·03	50·0	29·26	9·13	3·21	8·75	0·71	Poor ..	Good.
160	Queen Fair ..	,, ..	63	77·4	12·79	50·6	26·41	8·46	3·12	8·69	0·82	Good ..	Rather poor.
260	Solid-straw Tuscan	Horrelville ..	65	72·1	13·43	48·4	30·50	9·30	3·25	8·63	0·58	,, ..	Good.
157	,,	Ashburton ..	62	74·0	13·24	50·6	27·65	8·69	3·18	8·56	0·66	,, ..	,,
258	Dreadnought ..	Horrelville ..	62	75·6	13·24	48·4	30·37	9·74	3·12	8·44	0·68	Fair ..	Fair.
156	Yeoman.. ..	Ashburton ..	65	76·8	12·78	50·4	28·19	8·88	3·17	8·44	0·65	,, ..	Fairly good.
158	Major	,, ..	62	75·2	13·27	48·4	27·71	8·57	3·23	8·25	0·68	Good ..	Rather poor.
161	Velvet Ngapara ..	,, ..	64	74·1	13·56	51·0	27·81	8·92	3·12	8·25	0·60	,, ..	Fair.
162	College Velvet ..	,, ..	63	74·1	13·54	52·0	27·27	8·54	3·19	8·19	0·59	,, ..	Good.
254	Stand Up White ..	Horrelville ..	70	72·4	13·50	50·0	30·74	9·37	3·28	8·13	0·58	Fair ..	,,
152	College Hunter's ..	Ashburton ..	60	75·2	13·30	50·4	25·35	8·03	3·16	8·13	0·74	,, ..	,,
164	Solid-straw Velvet	,, ..	58	74·3	13·88	48·4	25·88	8·15	3·18	8·13	0·66	,, ..	Fair.
159	Essex Conqueror ..	,, ..	64	71·5	13·22	49·0	27·44	7·75	3·54	7·69	0·51	Good ..	Good.
255	Red Marvel ..	Horrelville ..	60	74·7	13·14	50·0	25·44	8·08	3·15	7·25	0·67	Fair ..	,,

NOTE.—All localities are in Canterbury—Horrelville in Eyre County, and Methven in Ashburton County.

to be good. Two samples of Jumbuck (W 168 and W 154) contained good amounts of protein; the gluten, although present in good quantity, appeared to be of rather poor quality; the water-absorption figures for the two samples were the highest recorded for either series. A sample of this variety tested in 1925 had an excellent capacity for water. White-straw Tuscan (W 171) gave a good yield of flour, and the protein content was well up to the average for the preceding three years; the gluten ratio was rather high. Of two samples of Red Fife, W 169 (Horrelville) contained a greater amount of protein than W 155 (Ashburton), although the quality of the gluten was fairly good in both cases. Marquis (W 166) contained a moderate amount of protein. This variety, together with Red Fife, has shown to better advantage in previous years, when both were classified as good strong samples. Quality White (W 259) was the best of the lesser-known varieties. Goldberry (W 172) gave a very good yield of flour, and contained moderate amounts of protein and gluten of fairly good quality. Queen Fair was represented by two samples (W 170 and W 160); the latter gave the highest yield of flour in this series, but the quality was inferior to that of the Horrelville sample. Two samples of Solid-straw Tuscan (W 260 and W 157) contained fair amounts of protein of good quality, the Horrelville sample being slightly the better. This variety and Dreadnought did not reach the standard of previous samples. Yeoman (W 156) gave a very good yield of flour, but appears to be rather variable in protein content. A sample from Lincoln in 1924 contained 7·94 per cent. protein, while in 1925 14·19 per cent. protein of fair average quality was recorded for an Ashburton sample. Major (W 158) also yielded a good amount of flour, but the gluten was of rather poor quality. The results for Essex Conqueror (W 159) are rather remarkable in view of the fact that this variety topped the 1925 samples with 14·69 per cent. protein, and was the best of the miscellaneous samples in 1924. The quality of the gluten in the 1925 sample was only medium, but the expectation that it would produce a loaf better than the average was fulfilled in the baking tests. The gluten in the present sample appeared to be of good quality. The ratio of wet to dry gluten was remarkably high.

1927 Series (Table 4).

The average protein content and the quality of these flours were on the whole considerably lower than in the preceding series. The outstanding varieties were Red Fife, three samples from Lincoln College (marked XI 27, XI 83, and XI 206 respectively), Goldberry (X 380), and Pearl. Marquis (X 366) contained a fair amount of protein, but the gluten was of poor quality, and the ash content very high. The three samples from Lincoln College (X 382, X 383, and X 384) were good all-round samples; the yield of flour was very good, and the protein of good quality; all three were characterized by a high ash content. Among the remaining varieties three samples of College Hunter's were of fairly good quality; X 369 (which gave the highest yield of flour in this series) had the highest protein content. College Velvet and White-straw Tuscan were of fair quality. A sample of Goldberry from Ashburton (X 370) was of rather poor quality. Yeoman II did not come up to the standard expected from the good yield and

Table 4.—Chemical Analyses, 1927 Harvest Wheats.

Laboratory No.	Variety.	Locality where grown.	Calculated Weight per Bushel.	Flour.	Moisture.	Absorption of Water.	Gluten, Wet.	Gluten, Dry.	Ratio of Wet to Dry Gluten.	Protein (N. × 6·25).	Ash.	Colour of Experimental Flour.	Quality of Gluten by Appearance.
X			lb.	PerCent.	Per Cent.	PerCent.	Per Cent.	Per Cent.		Per Cent.	PerCent.		
377	Red Fife ..	Lincoln College	60	74·7	12·43	49·0	30·39	9·93	3·06	8·88	0·78	Poor ..	Good.
382	XI/27	,,	64	76·6	12·32	48·0	28·92	9·47	3·05	8·88	0·83	Fair ..	,,
383	XI/83	,,	65	76·3	12·76	48·0	29·72	9·64	3·08	8·69	0·80	Poor ..	,,
384	XI/206	,,	64	74·9	12·49	50·0	29·16	9·57	3·05	8·38	0·82	Fair ..	,,
366	Marquis ..	Ashburton ..	66	73·5	12·58	50·0	25·54	8·36	3·05	8·38	0·86	Poor ..	Poor.
380	Goldberry ..	Lincoln College	65	76·8	12·66	48·4	30·39	9·75	3·12	8·31	0·59	Fair ..	Good.
441	Mixture ..	..	..	73·5	13·20	48·4	28·48	9·17	3·10	8·13	0·57	Good ..	Rather poor.
419	Pearl	Lincoln College	66	73·8	13·15	51·6	28·24	8·80	3·21	8·06	0·53	,, ..	Good.
372	Velvet x Solid-straw Tuscan	Ashburton ..	62	71·9	12·46	47·6	20·74	6·91	3·00	7·96	0·71	,, ..	Very poor.
369	College Hunter's (Control)	,, ..	63	77·7	13·29	49·0	24·39	7·92	3·08	7·96	0·66	,, ..	Fair.
374	College Velvet ..	,, ..	64	74·0	13·91	49·4	23·69	7·68	3·08	7·81	0·61	Fair ..	,,
375	Yeoman II ..	Lincoln College	63	76·4	13·16	49·0	24·20	7·71	3·14	7·69	0·70	,, ..	Rather poor.
421	Tuscan	,,	66	72·3	12·74	49·6	27·92	8·55	3·27	7·69	0·59	Good ..	,,
378	College Hunter's ..	,,	62	72·5	13·19	49·0	22·76	7·20	3·16	7·69	0·60	,, ..	Fairly good.
381	White Fife x Benefacti 2	,,	62	74·8	13·66	48·4	22·01	7·20	3·06	7·63	0·62	Fair ..	Poor.
420	Victor	,,	65	75·2	12·90	49·0	24·45	7·73	3·16	7·63	0·58	Good ..	Rather poor.
373	College Hunter's, 1926	Ashburton ..	64	73·5	13·27	47·6	22·67	6·92	3·28	7·44	0·57	,, ..	Fairly good.
361	Solid-straw Tuscan	,, ..	63	74·3	14·69	49·4	22·97	7·40	3·11	7·44	0·64	Fair ..	Rather poor.
418	Hunter's ..	Lincoln College	64	70·8	12·78	49·6	24·66	7·65	3·22	7·44	0·62	Good ..	,,
367	Essex Conqueror ..	Ashburton ..	64	75·0	13·31	49·6	23·70	7·23	3·28	7·38	0·54	,, ..	,,
371	White-straw Tuscan	,, ..	65	74·9	13·51	47·0	22·68	7·06	3·21	7·31	0·63	Fair ..	Fair.
370	Goldberry ...	,, ..	63	77·6	13·76	48·4	21·73	7·11	3·06	7·25	0·60	Good ..	Rather poor.
365	Queen Fair ..	,, ..	64	76·6	14·06	49·0	17·71	6·04	2·93	7·00	0·91*	*	Poor.
364	Major	,, ..	64	77·1	12·75	49·6	19·39	6·07	3·19	6·88	0·71	Good ..	,,
379	Bell	Lincoln College	58	73·4	12·75	46·4	22·76	7·04	3·23	6·69	0·62	,, ..	,,
376	Biffen II ..	,,	60	75·8	12·80	48·6	17·96	5·46	3·29	6·38	0·65	,, ..	Very poor.
363	Trifolium 14 ..	Ashburton ..	60	76·4	13·47	47·0	19·91	6·32	3·15	6·38	0·52	,, ..	Poor.

* First sample milled—contamination from mill.

NOTE.—All localities are in Canterbury—Lincoln in Springs County.

appearance of the flour. The reputation acquired by Victor of always giving a good yield of flour but failing in quality was borne out by the results for the sample tested (X 420). Three little-known varieties—Bell, Biffen II, and Trifolium 14—were of poor quality.

Summary and Conclusion.

The average protein content of the 1926 series flours was 9·0 per cent., compared with 7·7 per cent. for the 1927 series. The averages for the three districts represented were as follows :—

	Per Cent.
1926—	
Horrelville	9·3
Ashburton	8·6
1927—	
Lincoln	8·0
Ashburton	7·4

A comparison of the results obtained for the same variety of wheat grown in two different districts (1926 harvest) is presented in the following table :—

Variety.	Ashburton.			Horrelville.		
	Protein.	Gluten.	Ash.	Protein.	Gluten.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
College Hunter's..	8·13	8·03	0·74	11·25	12·37	0·69
Jumbuck ...	10·75	11·49	0·72	11·06	11·17	0·63
Red Fife ..	8·75	9·13	0·71	9·88	10·78	0·57
Queen Fair ..	8·69	8·46	0·82	9·00	9·93	0·56
Solid-straw Tuscan	8·56	8·69	0·66	8·63	9·39	0·58

It will be seen that in every case Horrelville produced a wheat of better quality than Ashburton. It is noteworthy that the ash content of the Ashburton samples is consistently higher. Sufficient data for a similar comparison of the 1927 wheats were not available, but it has been shown above that the average protein content for Ashburton was lower than that for Lincoln.

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(Series to be continued.)

Importation of Animal-manures.—Supervision of the sterilization of animal-manure consignments in Australia and India was continued under the direction of the Live-stock Division during the past year. The quantity of such manures imported into New Zealand has for some years been declining, but the importations from Calcutta during the past year (1,050 tons) show an advance. The importations from Australia amounted to only 215 tons. Increasing cost of production in the Commonwealth is said to be largely responsible for the falling-off.

GOATS AND NOXIOUS-WEEDS CONTROL.

ELIMINATION OF BLACKBERRY, GORSE, AND BRACKEN ON A TARANAKI FARM.

R. WRIGHT, Principal Inspector, Live-stock Division, Wellington.

A MOST practical and successful demonstration of the complete elimination of blackberry, gorse, and fern by means of goats in conjunction with heavy stocking, chiefly with sheep, has been given by Mr. E. J. Carthew, of Barrett Road, near New Plymouth. This work —which has been under departmental observation for some years— has resulted in the conversion of a blackberry and gorse infested holding of 131 acres into one of the cleanest farms in the district, and its maintenance in a weed-free condition during the past three years. The outstanding feature in connection with this matter is the fact that the land is being and can be permanently maintained in its present clean condition at extremely small cost, while its stock-carrying capacity has immensely increased.

When the holding was acquired by its present owner its carrying-capacity was some thirty cows, while during the past three years or more the farm (of which an area of about 100 acres is in pasture and the remainder in bush, &c.) has carried a flock of sheep numbering six hundred wethers during the summer months, with reduction to four hundred during the winter season, as well as several horses and a score or more of cattle. This is in addition to the goats, some two hundred of which were kept on the place for the first year or two. At the time of my latest visit of inspection, in January last, the number of stock on the farm was six hundred wethers, eight horses, twenty-three cattle, and forty goats, all of which had been grazing for some months on the 100 acres of pasture.

A systematic inspection of the entire holding has been made on each visit. On the first occasion, within two years of Mr. Carthew's entry into possession of the property, it was found that the old growth of blackberry, gorse, and bracken fern was apparently dead; a subsequent inspection confirmed this view, it being found that all such growth was down and had been burnt, the old stems and root-crowns being then completely dead and the crowns covered with an abundant sole of grass. Odd seedlings of both blackberry and gorse continue to make their appearance in many places, the ground yet being well supplied with seed from the past heavy infestation, and it is necessary to still keep a few goats (now limited to forty) on the farm to destroy these seedlings as they appear—which work the goats attend to most effectively.

Though I had not seen the area before the attack on the noxious weeds commenced, there was on my first visit clear evidence that practically the whole of the 100 acres of bush-free country on the place had been infested with blackberry and gorse, with some fern—but chiefly with blackberry. Mr. F. W. Sutton, Inspector of Stock, New Plymouth, who has an intimate knowledge of the district generally and of this farm in particular, states that when acquired by the present owner the property was so overrun with noxious weeds that

its value had been lowered in a few years by more than 50 per cent. Its present enhanced value is due to the effective riddance of the noxious weeds and consequent regrassing of the cleared areas, and not to any general rise in land-values in the locality.

On acquiring the farm the present owner made an attempt at hand-clearing, but found this a very slow and costly method, without any guarantee that the cutting and grubbing would have a permanent effect. The land is of a broken and ridgy nature, intersected with steep faces and gullies, and is therefore to a great extent unploughable; thus control by means of tillage could not be adopted. This being the case, after having cleared and burned the roughage of gorse and blackberry on some of the more accessible portions of the ridges, a change in plan of operations was made. It was decided to try the effect of a large herd of goats, commencing, as already stated, with two hundred of these animals. The method adopted was to first put on in one paddock forty or fifty cattle for a day to clean up any grass roughage and trample down some of the growth of rough weeds. As the cattle were moved on to another paddock several hundred sheep were brought in immediately following for one day, and as they in turn were moved a paddock farther on the goats were brought in to the first paddock (by then bare of all pasture) to get to work on the blackberry and gorse, &c. This process was continued through the whole series of paddocks—first cattle, then sheep, then goats, one following the other from paddock to paddock day after day and month after month.

After some preliminary experience Mr. Carthew found that for early success small paddocks were essential, and the farm was then further subdivided into fifteen paddocks. A regular routine was followed of moving the stock forward one paddock each day, the four hundred to six hundred wethers, together with a number of cattle, being followed one day behind by the herd of two hundred goats. Each paddock had fourteen days' spell before the stock again got round to it, and there was therefore a fair growth of fresh young pasture, &c., for the cattle and sheep in each field as it was reached, but little or none for the goats following after. These animals therefore made a severe attack on the weeds, with very effective results. The good work of the goats was early apparent, and in a very short space of time it was evident that the complete elimination of all noxious plants was assured.

After carrying on this system for some time Mr. Carthew decided to run all the stock together, with the usual daily shift of one paddock ahead, and he states that the results of this later method were equally satisfactory. On the farm to-day there is not a blackberry-vine nor a gorse-bush to be seen, all having been cleared out of even the steepest and most inaccessible creek-beds.

Mr. Carthew firmly holds that there need be no separation of the goats and sheep—that there is no need to have the goats following one paddock behind the sheep. My own opinion, however, is that better results and earlier riddance of blackberry, &c., will be effected by having each paddock eaten bare of pasture before the goats are turned in, as then they must devote the whole of their feeding to the vines and shrubs, there being practically nothing else left for them.

The subdivision of the area into smaller paddocks was done by the erection of temporary fences, all the lower wires being barbed. Barbed wire was also put round the boundary-fences of the farm in order to confine the goats to their own domain. The goats were obtained at an average price of about 5s. each, the total cost of the two hundred being about £50, and this expenditure was recouped to the owner by additional profits from the sheep in a very short space of time. Contrary to expectations, the sheep were found to keep in excellent condition, many being fit for the butcher; each autumn, as a matter of fact, a fair draft of fat wethers has gone from the farm to the meat-freezing works. The wool-clip has also been very satisfactory, and though damage to the fleeces from the barbed wire fences might have been expected there was no evidence of any injury from this cause.

Good fences are essential to success, and experience has proved to Mr. Carthew that wether goats are the best workers, though a certain number of nannies and billies require to be kept to maintain the supply of goats, unless they can be cheaply obtained from outside. Mortality among the kids is heavy when the goats are being continually moved. For breeding purposes the proportion of the sexes is much the same as with sheep—one billy to forty or fifty nannies.

Mr. Carthew proposes to top-dress the farm with fertilizer at an early date, and if this is done its carrying-capacity should be still further improved, though it is hard to imagine much increase on the quantity of stock now carried.

THE CATTLE-TICK POSITION.

THE incidence of the cattle-tick (*Haemaphysalis bispinosa*) in the Dominion during the past year is dealt with by the Director of the Live-stock Division (Mr. J. Lyons) in his annual report for 1926–27 as follows:—

The infestation of stock with cattle-tick within area A, with the exception of the Tauranga and Coromandel districts, has been much lighter than for some years past. The cold season experienced may account for this to some extent. There are, however, other factors at work, such as picking and spraying. It is also realized that better farming methods, such as top-dressing, keeping the roughage eaten out, ploughing, and burning, are all factors which assist in reducing the ticks to a minimum. The hearty co-operation of settlers is asked for in this respect. If owners will individually see that their stock is kept free from ticks, and that their pastures are kept free from roughage, which affords a breeding-ground for the tick, it will go a long way towards the eradication of the pest. Where dairying is carried on, the method of control is comparatively simple. It is on the grazing-runs, where stock are seen only at irregular intervals, that difficulty is experienced. However, much may be done in the latter case by occasional dippings, and also in destroying all roughage on the farm. In area B the position is better than it has been for several years. Very few fresh farms were infested, and in the majority of farms where ticks were found on stock in previous years none was found. The position at Waitara has improved; only a few ticks were found this season, and those all on properties previously affected. A constant inspection of all cattle within the area has been maintained, and all cattle within the area have been dipped or sprayed before removal. It is to be regretted that during the season a further development took place regarding cattle-tick in the Poverty Bay district. Ticks were reported on several properties in an area adjacent to Tolaga Bay. Every endeavour was made to locate and eradicate the parasites in this district. Regular inspection of all neighbouring stock was carried out, and spraying and burning of cover were resorted to, and it is hoped that by these means the tick will be eradicated.

CONTROL OF VINE DISEASES AND PESTS OCCURRING IN NEW ZEALAND.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

THE object of this article is to assist the vine-grower in distinguishing the principal fungous diseases and insect pests of the vine present in New Zealand, in avoiding conditions favourable to their development, and in controlling them when present The treatment advised is subject to modification by the experienced vigneron to suit the climatic and general conditions of his particular district and the severity of attacks. While in many cases control is of value, the vigneron's slogan in regard to these troubles should be "prevention."

1. FUNGOUS DISEASES.

Oidium or Powdery Mildew (Uncinula spiralis).

Oidium is well known throughout the viticultural areas of New Zealand, where it causes losses in both vineyards and vineries. Few of the European vines are proof against the attacks of Oidium; American varieties are more resistant — some quite so, and hybrids more or less so.

This fungus attacks all the green parts of the vine. Its mycelium, unlike that of downy mildew and anthracnose, develops on the outside of the organs of the vine, and is furnished with suckers to extract its food. The mycelium is therefore exposed to the direct effects of fungicides, which makes its control a comparatively easy matter. The fungus develops in warm, humid, cloudy weather, often when this follows a sudden spell of cold. Any atmospheric condition which causes a limp condition of the foliage weakens its power of resistance (see this Department's Bulletin No. 102, "Vine-culture under Glass," page 26). Vines growing on pergolas, on high trellises, against walls, and in low or sheltered spots in the vineyard are more liable to be affected than those trained on low trellises or on slopes or hillsides. Vines with soft luxuriant foliage, due to an excess of moisture or nitrogenous manure, are especially vulnerable.

Oidium makes its first appearance on the young leaves and shoots as small whitish patches. These appear on both sides of the leaves, and if not checked will extend and cover the whole surface and eventually destroy the leaves. The mycelium and the myriads of conidiophores which cover the leaves give them the appearance of having been freely powdered with a fine greyish-white powder—hence one of the names by which the fungus is known. If this powder is rubbed off the leaf a dirty green surface, dotted with small brown specks, is exposed. A distinctly mouldy odour always accompanies the fungus.

The young shoots when badly affected fail to develop, turn brown, and are easily broken off. If the bunches are affected in their early stages of growth the flowers fail to set, or the young fruit if formed is destroyed. Later the berries become covered with a felt-like mould, which when it falls off leaves the skin hard and liable to burst Many

of the berries do so, splitting down one side and exposing the seeds and pulp to view, thus giving free access to fungi and insects. The grapes are not resistant to Oidium until they begin to colour.

Preventive Treatment where Oidium is endemic.—Dust the vines with very fine sublimated or precipitated flowers of sulphur—not ordinary

FIG. 1. OIDIUM OR POWDERY MILDEW AFFECTING LEAVES AND BERRIES.

[*From "Les Maladies de la Vigne."*

ground sulphur—having a velvety feel free from grit, adding one-third its volume of sifted air-slaked lime, or, better still, fresh quicklime hydrated by adding water to it in the proportion of 1 gallon to 30 lb. lime—(1) when the shoots are from 4 in. to 6 in. long, (2) when the blossoms are open, (3) when the grapes attain one-third of their size.

This programme can be modified to suit climatic conditions and the virulence of the attack. The sulphur can be applied at any time of the day, excepting during hot sunshine, when there is a danger of burning the foliage. Use should be made of the direction of the wind to keep the sulphur away from the eyes as much as possible, and the vigneron should avoid rubbing his eyes. If notwithstanding all precautions the eyes feel sore, all sulphur should be carefully removed from the face and the eyes bathed in a solution of bicarbonate of soda, boracic acid, or a little sweet milk.

Sulphur acts as a preventive and a slow cure for Oidium. As a preventive it should be applied, at the latest, when the faint whitish spots begin to appear on the foliage. Where the Oidium has become well established on the vines a solution of permanganate of potassium, which destroys all mycelium and spores it comes in contact with, should be applied for immediate results. To make the solution 1½ lb. permanganate (or Condy's crystals) is crushed to a fine powder and dissolved in about 2 gallons of hot water, and when thoroughly dissolved (which takes some time) the volume is increased to 100 gallons with water. The mixture should be made in a metal container. Wooden containers should not be used, with the exception of those previously used for preparing bordeaux mixture. The concentrated liquor is very corrosive, and should be handled with care, or severe burns will result. Permanganate is effective when mixed with bordeaux, on condition that the latter is free from spreaders. When mixed with water an addition of 30 lb. of fresh quicklime renders the solution more adhesive to the berries. The permanganate solution should be applied through a nozzle giving a fine mist spray, and at a sufficient distance from the vines to allow the liquid to spread out.

The fumes of sulphur which control the Oidium are not very effective when the temperature is below 90° F.—a condition which is usual in our climate. For this reason it will often be found advantageous in cool weather to use lime-sulphur solution, in which the more finely divided forms of sulphur are quicker in their action than those of the dry form of sulphur. Some of our leading vignerons have entirely discarded the use of dry sulphur in favour of the lime-sulphur solution, and obtain a satisfactory result with a weak solution of 1 part of commercial lime-sulphur in 100 parts of water, applied at the same periods as dry sulphur would be, with the exception that it is not used during the blossoming-period, but just before the flowers open. Dry sulphur assists the fruit in setting, whereas the liquid form has a contrary effect.

Downy Mildew or Peronospera (*Plasmopara viticola*).

This fungus (a recent arrival as regards vine-growing in New Zealand) develops under conditions of heat and humidity in the late spring or early summer, and is usually observed about seven days after rain, fog, or heavy dew followed by a warm sunny day. Under favourable conditions fresh outbreaks recur throughout the season, and may destroy the whole crop and jeopardize the crop of the following season.

Downy mildew destroys the young shoots, leaves, and flowers or berries, and attacks and damages the more matured leaves and berries.

It can easily be distinguished on the leaves, on the upper surface of which it forms irregular separate or merging spots, varying in colour from light yellow to reddish-brown, with corresponding areas on the under-side covered with an efflorescence resembling hoarfrost. This efflorescence does not develop under very dry conditions, and as it is

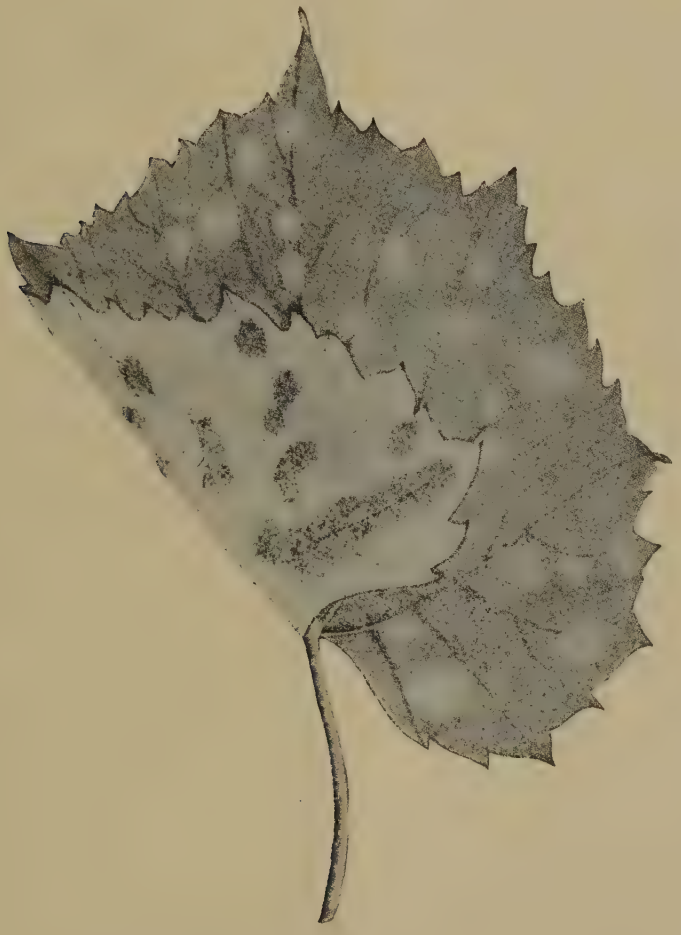

FIG. 2. VINE-LEAF ATTACKED BY DOWNY MILDEW.
Showing appearance of leaf on upper and lower surfaces.

[*From United States Farmers' Bulletin 1220.*

composed of fruiting-organs the spots remain sterile. The young green shoots when attacked by downy mildew show spots like those on the leaves, but less easily distinguishable. Later the shoots take on a dark-brown colour and break off with the slightest touch.

In the bunches, before or just after the fruit is formed, the stalks become black and the flowers or the fruit fall off. If the fungus

arrives a little later the berries are covered with a greyish-white down, and soon dry up. When larger, the berries take on a reddish-brown colour and fail to ripen. The fruit is not safe from the fungus until the berries begin to colour, but the quality of the juice can still be affected by the action of the fungus on the leaves.

The treatment is essentially preventive. In normal seasons spray with a 2-per-cent. bordeaux or burgundy mixture (2 lb. sulphate of copper to 10 gallons water, with just sufficient *fresh* lime or soda to neutralize the acidity) during the critical period—that is, up to the time the berries are about half-grown—followed by a weaker spray of 1 to 1½ per cent. strength. Last season (1926–27) a few vignerons used a 3–4–50 bordeaux in the early part of the season, which was particularly favourable to the development of fungous diseases, instead of a 2-per-cent. or 3-per-cent. mixture, and suffered considerable losses in consequence.

The spray should be applied as follows: (1) As soon as possible after the buds break; (2) before the flowers open; (3) when the petals have fallen; (4) fourteen days later, or as required, in seasons favourable to the development of the disease. Young shoots and bunches of flowers and young grapes should be well covered and penetrated with spray. To ensure the adhesion of the spray to the bunches the addition of a spreader is necessary on account of the waxy nature of their surface. In seasons favourable to downy mildew fresh applications of bordeaux should be made to the newly-grown leaves as they appear, while there is still a residue of former treatments on the vines. To permit of the spray penetrating to all the green parts of the vine, and to facilitate their drying quickly after rain or fog, disbudding, tying up, and topping should be executed as soon as the growth of the vines warrant these operations. All weeds should be kept down, and the driest conditions possible aimed at.

In districts where the fungus has made its appearance the first three sprays may be considered to be essential, and the strength of the bordeaux can be increased and the spray applied more often in cases of virulent attacks, or where the spray has been washed off by the rain. It is essential that a complete armour of copper salts should cover the growing organs of the vine. The young vines in the nurseries should not be neglected, as they are even more susceptible to the disease than the older vines.

For table grapes nearing the ripening stage bordeaux can be replaced by a spray composed of 2 lb. of verdigris dissolved in half a gallon of water and completed with water to 22 gallons. This is quite as effective as bordeaux, and will not mark the grapes.

The life-history of downy mildew is given in the Department's Bulletin No. 127, which may be obtained free on application.

Anthracnose or Black-spot (Maginia ampelina).

Anthracnose develops in the late spring and early summer under warm and humid conditions. It is also known as the "bird's-eye rot," which aptly describes the appearance of the round spot on the berry, with its rosy-grey centre and dark edges.

On the leaves small reddish-brown spots form and dry out, leaving an irregular hole with a black border. Small black spots, growing to

elongated sunken areas, rosy-grey with a dark border, extend along the stalks of the leaves and young shoots. A number of these cankers forming on the same leafstalk or shoot is liable to destroy it completely, and if the disease is allowed a free course the vine will become stunted and eventually die. Several spots forming on one berry may cause it to fall. One or two are sufficient to cause the berries to split and allow decomposition to set in, and this is how the greatest loss is generally caused.

FIG. 3. FEATURES OF ANTHRACNOSE OR BLACK-SPOT.
[*From "Viticulture Moderne."*

Treatment.—About fifteen days before vegetation starts—when the buds are beginning to swell—spray with 2-per-cent. bordeaux, taking care to cover thoroughly the previous year's growths. It is from the old cankers of these that the new green growths are liable to become infected. Spray again with a 1-per-cent. bordeaux when the young shoots are 3 in. or 4 in. long. Further applications of bordeaux can be made if the disease is making any progress, before flowering and after the fruit is set, and again fifteen days later. The danger of infection ceases when the berries begin to colour.

Grey-rot (Botrytis cinerea).

Very humid conditions are essential for Botrytis to develop sufficiently to become dangerous in the vineyard. Under favourable conditions this fungus attacks the foliage and young fruit of the vine in the early part of the season, and later when the grapes are colouring. Ideal conditions for its development are frequently observed in

vineries where there is an excess of foliage on the vines, combined with a damp steamy atmosphere owing to want of ventilation. In the Auckland district the fungus occasionally develops in the best regulated houses, owing to persistent muggy atmospheric conditions outdoors.

In the vineyards the attacks are usually observed in the autumn, but last spring and early summer (1926–27), during which climatic conditions were abnormal in the Auckland district and exceptionally favourable to the development of fungous diseases, a number of early infections were brought to my notice. In the early part of the growing season Botrytis makes its appearance as small yellow spots on the leaves. These spots extend gradually, and eventually become covered with the characteristic grey mould. The green parts of the young shoots offer an exceptionally favourable medium for the development of the fungus, and as a result are quickly killed. The green bunches may be affected at any point, and if it happens to be at the stem the whole bunch will be lost. Spots form on the young berries similar to those on the leaves, and spread very quickly if weather conditions continue to be favourable.

Later, as the lignification of the young growth proceeds and becomes more resistant, the fungus does not affect the vine until towards the end of the season when the grapes are colouring, and then only if continual rains or persistent fogs become the order of the day. The excessive moisture swells the berries, and the extended skin cracks, allowing the juice to exude and spread over the berries. This offers an ideal medium for the development of the fungus, which quickly covers the surface with fluffy grey mould, generally accompanied with Penicillium and other moulds. When the berries do not crack they become soft, covered with mould, and eventually shrivel up to mummies which, with the young wood, help to carry the fungus over the winter in the form of small black nodules or sclerotia.

If the grapes are attacked when nearly ripe, and there is no hope of controlling the fungus, they should be gathered at once and the juice fermented apart from the skins and made into white wine (in the case of black grapes), as a few days' delay may mean the loss of the whole crop. The juice should be separated from the berries as quickly as possible, and 6 oz. of metabisulphide mixed in hot water in a wooden or enamel vessel added to each 100 gallons of the must. This will exterminate all undesirable ferments and destroy the oxydase, which is the cause of "brown casse" in red wines and the yellowing and browning of white wine. When the must has reposed for forty-eight hours draw off the clear liquid into vats or barrels. Add a little fermenting must from a starter prepared for the occasion from sound grapes, and 1½ oz. of tannic acid per 100 gallons. When racking later run the wine into well-sulphured containers. Crops that have suffered badly from downy mildew and Oidium should be treated in the same manner.

It is an interesting fact that this undesirable rot under ordinary conditions is welcomed in some of the European viticultural districts—Sauterne, Rhine, and Anjou—where the principal varieties, Sauvignon, Semillion, Muscatelle, Riesling, and Chenin Blanc, which have resistant skins, are grown. In these districts, where a dry autumn

is the rule, the fungus, by diminishing the thickness of the skin, allows some of the water of the grape to evaporate, and at the same time develops a particular aroma which is considered desirable in this class of wine. Under these conditions the fungus is known as *pourriture noble* (noble rot).

Treatment.—The effect of the damp conditions under which Botrytis develops should be reduced as much as possible by suppressing useless foliage and keeping the vines open and exposed to the drying effects of any breeze that comes along. The drainage should be good. In planting new vineyards choose a slope facing the north or north-east;

FIG. 4. GREY-ROT OR BOTRYTIS CINEREA.
Left, noble rot; right, common rot—both in advanced stage.
[*From "Cours d'Oenologie."*

avoid gullies and hollows. Late close-bunched varieties can be protected to some extent by stripping all the leaves off the vine below the bunches when the berries begin to colour, which will also advance the ripening. In table varieties thinning the berries of the bunches is recommended.

The appearance of the disease in the early part of the season has been rarely recorded in New Zealand, and viticulturists in other countries, as far as I can ascertain, have not yet found a reliable control. There is, however, a general preference for powder over liquids, and out of the many proposed remedies the following dry mixtures (the ingredients of which can be readily procured in New

Zealand) might be tried: Lime, air-slaked or hydrated (see control of Oidium), half of each; or 85 parts of hydrated lime and 15 parts of finely pulverized Condy's crystals (permanganate of potash). When dusting the vines special care should be directed to giving the bunches a good covering.

Root-rot or Pourridie of the Vine.

The roots of the vine are subject to injury through excessive moisture, from insects which feed on them, from fungi and bacteria which obtain entrance through the holes made by the insects, through faults in imperfect unions on grafted vines and accidental wounds, and from other causes. In their weakened non-resisting condition the roots form an easily invaded favourable medium for the development of that class of fungi which seem to have the special mission of reducing wood to earth again. These fungi seem to be universal, but their presence is especially noticeable in areas recently covered with bush, where there is generally plenty of rotting wood, roots, &c. The mycelium of the root-rot fungus spreads through the soil and enters the vine from the smaller roots, gradually working up the main roots to the surface, causing destruction on its way.

The first sign of the effects of root-rot is an abnormal crop of grapes, followed by a weak stunted growth of the young wood, with undeveloped leaves. The vine is starving from want of nourishment from the roots, and soon dies.

When the disease is well advanced the vine can be easily pulled out of the ground; on examination the roots will be seen to be black and rotten, and if broken a viscous liquid will exude. On lifting the black bark a number of white branching filaments will be noticed running up to or above the soil-level. (An interesting account of root-rot in New Zealand will be found in "Fungous Diseases of Fruit-trees," by Dr. G. H. Cunningham, Mycologist to the Department of Agriculture.)

Treatment.—The root-rot fungus generally spreads from the first vine affected to adjacent vines, and on account of its subterranean habits is very difficult to control. The vines that show the slightest sign of being affected should be dug out with their roots and burnt on the spot, and the soil disinfected with 1½ oz. per square yard of commercial carbon bisulphide inserted in three or four holes 1 ft. deep in each square yard. The holes can be made with a dibble or Vermorel's forcing-syringe (*pal Vermorel*), and, after the disinfectant has been poured into them, covered with earth. The ground can then be sown with crops for three or four years, then treated again with carbon bisulphide, and replanted with vines. The expense of the treatment with carbon bisulphide would be justified only under special circumstances.

In planting a vineyard on recently cleared bush or orchard all stumps and roots should be carefully extracted, and, together with all other fragments of wood, burnt or disposed of elsewhere. All wet spots should be carefully drained, and posts used for supporting the wires should have their ends charred or tarred before placing them in position so as to prevent rotting.

Crown-gall or Broussin of the Vine.

This disease is caused by the bacterial organism *Pseudomonas tumefaciens*. The tuberous growths generally form just above soil-level on European varieties, and are sometimes very large. On American vines they appear as small, numerous, wart-like galls in elongated masses along the trunk and main branches.

Treatment.—Remove the growth with a knife, and paint the wound with a saturated solution of sulphate of iron in cold water, 3½ lb. to the gallon.

2. INSECT PESTS.

Phylloxera (Phylloxera vastatrix).

Phylloxera is the most dreaded insect enemy of the vine. It was reported in New Zealand in 1885, and has since spread over the Auckland Peninsula from Auckland City to the North Cape. The insect goes through a number of metamorphoses, and its life-history varies with the climate and the variety of vine it is living on. On European vines and American-European hybrids it is found principally on the roots and rarely on the leaves. The leaf form is found on the American and hybrid varieties. The leaf or gallicole form of the insect (if it exists in New Zealand) has not been reported as doing any damage, but the radicole or root form has exterminated most of the vines in vineyards and vineries in North Auckland wherever the vines were not established on resistant stocks.

Phylloxera can be disseminated by transporting grafted vines or vines on their own roots from infected areas to clean areas (which is prohibited, and for which heavy penalties may be incurred), or by a female form of the insect which develops long wings in the summer and with the aid of the wind is carried long distances. In vineyards or vineries the insect migrates from one vine to another through the soil. It can just be seen on the roots with the naked eye, but better with a magnifying-glass, in several of its forms, yellow and orange in colour.

The leaves on affected vines become yellow, the grapes fail to ripen, and the general appearance is like that of vines attacked by root-rot. The condition of the roots, however, differs. On examination a number of nodules shaped somewhat like birds' heads will be found on the rootlets, and tuberous swellings on the more matured small roots. These nodules and swellings form where the radicole form of the insect has punctured the bark with its rostrum to extract food. They form in spring and early summer, and rot in autumn and early winter, finally killing the roots. The vine defends itself by throwing out new rootlets and by forming new bark, but the fight is an unequal one, and the plant generally succumbs in from three to four years. The vines resist the longest in rich loose soils, where the plant can throw out roots freely. On sandy soils the phylloxera is unable to exist on the roots, and in them ungrafted vines are safe from its attacks.

Control.—The insect can be controlled by injecting carbon bisulphide into the soil, but the effects are only temporary, and this method is now generally abandoned in favour of grafting the vines on American or hybrid phylloxera-resistant stock. The phylloxera can live on the

roots of these stocks, but they do not increase so rapidly on them, and the punctures they make cause comparatively little injury.

The best phylloxera-resistant stocks obtainable have been introduced from time to time by the Horticulture Division, and are to be had from nurserymen or from the Te Kauwhata Horticultural Station. Intending planters are invited to consult the Division as to the choice of stocks to suit the soil on which they intend planting, and as to their affinity to the scion varieties to be grown.

Caterpillars.

The chief culprit among the caterpillars has been identified by Mr. David Miller, the Agriculture Department's Entomologist, as the common leaf-roller, the larva of the oblique Tortrix (*Ctenopseustis obliquana* Walk.). The Tortrix family includes two of the worst insect pests of European vineyards, the Cochylis (*Tortrix ambiguella*) and Pyrale (*Tortrix pilleriana*). It therefore behoves us to keep our member of the family within bounds. It has already caused considerable loss to the table-grape growers at Te Kauwhata during the last two seasons.

Control.—Spray with arsenate of lead, 1½ lb. paste or ¾ lb. of powder to 50 gallons water (2 oz. paste or 1 oz. powder to 4 gallons water), (1) when the young shoots are 6 in. long or as soon as the young caterpillars are observed, (2) when the fruit has set, (3) a fortnight later. If spraying with bordeaux or lime-sulphur, combine the arsenate of lead with them. To the lime-sulphur add 2½ oz. of casein per 50 gallons; mix the casein in a quart of water; slake 2½ oz. of lime slowly, and increase the quantity with water to a quart; pour the lime water slowly into the casein, stirring well, and pour the mixture into the water, again stirring well, then add the concentrated lime-sulphur and arsenate. Avoid using arsenate when the flowers are in bloom, on account of the risk of poisoning bees.

For destroying the caterpillars nearer ripening-period use Black Leaf 40, 1 in 1,200 (½ pint in 75 gallons, or ¾ pint in 100 gallons of water or bordeaux).

Mealy bug (*Pseudococcus adonidum*).

The mealy bug is an occasional visitor to the vineyards in New Zealand, and increases very rapidly if undisturbed.

Control.—After pruning the vines and burning the prunings strip off all the old bark and spray with lime-sulphur, 1–8.

Bronze-beetle (*Eucolaspis brunnens*).

This small brown beetle generally appears in December, and attacks the young growths, generally the stems of the bunches. The greatest damage has occurred in vineyards where the vines were grown on the telegraph system—three horizontal wires—and under which the ground was left undisturbed. In well-cultivated vineyards the damage done by this beetle is insignificant.

Greater Vine-scale (*Lecanium berberidis*).

This is a large brown oval scale usually found on the wood of the previous season's growth of the vine.

Control.—In winter burn the prunings and apply lime-sulphur, 1–8. In early summer watch for the young emerging. They are pale yellow in colour, and should be destroyed whilst still soft with Black Leaf 40, $\frac{4}{5}$ fluid oz. in 4 gallons of water in which 2 oz. of soap has been dissolved.

NOTE.—The methods of treatment and control of diseases and pests affecting vines more particularly in vineries are dealt with in the Department's Bulletin No. 102, "Vine-culture under Glass," supplied gratis on application.

MINERAL CONTENT OF PASTURES.

IN his annual report for 1926–27 Mr. A. H. Cockayne, Director of the Fields Division, makes the following remarks on this subject:—

It would appear that most of the work performed in Great Britain and elsewhere on the mineral content of pastures has for its objective the determination of definite mineral deficiencies that lead to definite malnutrition of stock. This work also is of importance to New Zealand, but doubtless it should form but a part of a larger and fuller scheme that has for its objective the total nutrient content of pasture herbage.

The determination of the nutrient content of the constituent species of pastures is important mainly from four aspects: (1) From the point of view of formulating the highest potential food-value pasture mixture possible to secure on each soil-type; (2) from the point of view of determining the optimum milk-producing life-form stages, as distinct from the non-milk-producing life-form stages, fattening and non-fattening life-form stages, of the herbage of the component species of the pasture on each soil-type; (3) from the point of view of determining nutrient (including mineral) content alterations that occur on top-dressed land; (4) from the point of view of determining on certain soil-types mineral deficiencies that result in definite stock malnutrition.

Before we can really claim to be in the best position possible we must know the species thoroughly—(1) morphologically, (2) ecologically, and (3) chemically. Determination of relative nutrient content will help towards maximum efficiency in regard to mixture formulæ. The determination of nutrient content at different stages in the life-form of the individual should throw much light on why certain farm practices are preferable to others. The stage of growth underlies a fundamental principle in pasture-management, and virtually the whole of efficient pasture-utilization has for its objective the maintaining of the pasture herbage in that condition of growth that stock produce their best when grazed upon it. In other words, there is a stage in the growth of all species when nutrient content is at a maximum. The determination of this maximum point by chemical analysis would be of infinite value towards directing pasture-management on the best possible lines.

The part played by top-dressing in providing a better-balanced mineral ration to stock may be to some extent measured from chemical analyses of the herbage from top-dressed and un-top-dressed soils, and in the case of definite malnutrition areas the determination of some mineral shortage may lead to corrective methods along the lines of top-dressing the pastures with suitable fertilizers.

National Arboretum.—This year's annual report of the State Forest Service states that the original area of 50 acres acquired for the establishment of the national arboretum at Rotorua has been extended by the acquisition of 29 acres of adjoining land. Stocks of about two hundred and fifty indigenous and exotic species are being raised in the Whakarewarewa Nursery for the arboretum, and the first instalment of specimens will be planted therein during the 1928 planting season. Every effort is being made to make the arboretum fully representative of the world's principal softwood utility and ornamental trees.

ANIMAL HUSBANDRY.

J. McLINDEN, M.R.C.V.S., N.D.A., Officer in Charge, Animal Husbandry Branch, Live-stock Division.

LITTLE introduction is required to the subject of animal husbandry. On the institution of the Animal Husbandry Branch as a distinct unit of the Live-stock Division, however, an indication of the ground to be covered may no doubt be desirable. For a number of years past the general trend of all things pertaining to agriculture has been towards specialization. The institution of the new branch means that certain officers will be freed from all other duties so that they may devote their full time to the advising of farmers seeking information on the breeding, feeding, and general management of their stock.

Animal husbandry, concisely though somewhat crudely explained, means the study of the breeding, feeding, managing, and marketing of farm stock for their respective purposes as economically as possible, yet with due regard to all other branches of farming, so that the latter may in no way suffer, but be utilized to their fullest capacity. It is quite a simple matter to achieve wonderful results in some particular branch of husbandry at the expense of another, but it is not quite so simple a matter to achieve equal results economically. If there is no economy effected—a real economy, of course—by the system adopted, then the results must be false and misleading.

BREEDING.

Volumes could be written on the subject of breeding -and all to little purpose. This is a subject, so far as high-grade pedigree stock and the more subtle refinements of type are concerned, which cannot be dealt with satisfactorily on paper, because it is an art. Provided, however, the discussion is confined to ordinary commercial stock, much interesting and valuable information of a practical nature can be given from time to time. What can be done is to keep before the farmer the type of stock required, the interpretation of milk records, the building-up of the dairy herds from inferior stock, and suchlike.

Then, there is the breeding and fattening of pigs. A cursory examination of commercial stocks is enough to show that great losses must be suffered annually through want of uniformity of type, size, and age. This Branch will act as a source of information on these matters, especially for those who have not yet attempted the fattening of pigs for pork or bacon, in which many no doubt have refrained from participating through lack of confidence. Dependence on the next-door neighbour for information may not always be a bad method, but the information often quite inadvertently proves to be wrong. This is especially true where the trouble happens to be malnutrition, or in some instances even overfeeding. It is not only necessary to know what type of commercial stock to breed, or in some cases to procure, but also to be in a position to know how to feed the stock profitably once they are established.

FEEDING.

In New Zealand the matter of feeding presents many peculiarities. The country is to a great extent isolated and away from the great

trade routes, with the result that supplementary feeding is chiefly dependent on home-grown supplies. The economic use of such foods as linseed cake, cotton-seed cake, &c., for ordinary commercial herds at the present time, unless in exceptional cases or for special purposes, is hardly feasible. So, with a general routine method of feeding, concentrates may be passed over. A very large proportion of the farmers of the North Island could be described as graziers pure and simple. It is easily understood how it is questioned whether even a small amount of cropping is profitable on high-priced land. By actually costing the crop, more than probably it would not be found profitable. But the value of the crop as a diet to the stock in times when grass is scarce must be reckoned. The cost of a crop produced in no way represents its feeding-value, and the feeding-value in turn in no way represents its value as a food when the natural food is not able to sustain the stock, such as in winter and early spring.

Health of stock means a great deal. If stock are not kept continually in a thriving condition, then there is no saying how far-reaching the losses are going to be. Once a dairy cow, for example, is allowed to fall off in her production she will never be brought back to her full yield again in that season. That is why the spring is so critical a period. No doubt such cows will improve as the season advances, but never to the level that should have been attained. Climatic conditions are frequently blamed for the lack of cropping in certain areas. The conditions certainly may not always be of the best, but more could be done in the way of producing supplementary food. A good example has been set by many farmers, and it is to be hoped that the majority will follow suit.

As breeding advances in regard to production, so must the feeding. A cow in her normal or wild state will furnish enough milk to feed one or two calves. Compare that animal with the good dairy stock of the present day, the result of intensive breeding by the use of good sires and judicious culling. On an average, they are producing very much more than just sufficient to feed a couple of calves. The present-day cow is expected to give, say, 300 lb. or 400 lb. of butterfat on the very same diet. The defect may not show up at once, but it will in later generations. The production of the cow has been bred up, but has the bowel-capacity been increased? It certainly has not been increased in proportion to production. It must be remembered that as production increases, the quantity and quality of food required increases at a greater rate, thus following the law of diminishing returns. This means that as it is impracticable to breed up an animal possessing enormous digestive capacity it is essential that food of high feeding-value and less bulk, such as farm grains, silage, and hay, be substituted, especially in times of grass shortage.

Of course, great differences occur in the feeding-value of the same crop grown in different localities and even under different systems of farming. A well-mixed pasture will have a far greater feeding-value than one containing practically only one type of grass. This in turn is superior to one which is well mixed with weeds. Even with apparently good well-laid-down pastures the system of manuring and management will greatly influence feeding-value.

MANAGEMENT.

The system of management adopted throughout the countr with many dairy herds is doubtless a survival of the days when the chief industry was the fattening of stock. Although fattening stock may profitably be kept continuously outside without cover or shelter, it does not follow that the same method can be successfully carried out with dairy stock. They require much greater protection. At any rate, there are very few farms which would not be benefited by a more liberal provision of shelter-belts, and the use of good warm covers on the stock should also be made more general. Treat a dairy cow well and she will do her best; treat her badly and she will return accordingly. It is difficult to understand why some men will make every endeavour to increase production by judicious breeding and yet overlook the necessity of good shelter and the use of covers during the rough, cold season. Comfort must be attended to as the production value of a herd improves. There is no doubt about stock being under much healthier conditions when kept outside, but it is essential that the animals be given proper protection and made comfortable.

The two factors, health and production, are valuable assets when found together. Production with lack of constitution, or one undermined through lack of sufficient nutrition at all times, will assuredly end in failure. It is when increased production is being achieved that any faults or flaws in management become apparent. With the exercise of care and with selection the production value of a dairy herd, for example, can be materially increased by using good-quality bulls; but at what cost if due care has not been observed in diet, breeding, culling, and management? Many a good herd has been ruined by owners taking too narrow a view and failing to keep all other necessary factors in line with the advance in production. If output only is kept in mind, and necessary care in breeding and feeding neglected or overlooked, the health of the stock is bound to suffer.

The production problem for those engaged in the fattening of pigs is really how they are going to defeat time and prevent time from defeating them. It is to be hoped, with better methods being adopted, that this industry, instead of turning its capital over once every twelve months, will be in a position to turn it over twice in the same period. It is the interest on the turnover of capital that is required for successful farming. Once a year is too slow.

Under present economic conditions the farmer is being compelled to demand from his stock the greatest possible returns for the capital and labour outlay. If a cow, for example, can be bred which will give 400 lb. of butterfat per annum on practically the same feed as another which will give only 250 lb., it is the former cow which the farmer at the present day finds he must keep. It is to be regretted that far too many cows have found their way into the milking-shed, and remain there, which should have been culled at least after the completion of their first season. True, all farmers are quite well aware of the fact that it does not pay to keep a poor producer, but obviously they do not all fully realize the importance of carrying their convictions into effect. It would be wrong to say that the presence of so many uneconomic producers in herds at the present day was due to sheer carelessness, nor would any farmer knowingly retain such a class of

stock if he could do otherwise. But too often the poor unprofitable stock are removed—only to be bought and taken into other herds.

Frequently it does happen that a farmer is compelled to buy in cows at calving, but to make this a rule—to depend on a supply of fresh material for the herd from the local stock-sale—is indeed the poorest of poor practice. Yet that is actually what is commonly happening. No one will deny that many high producers have been procured in this way, but their proportion to the low producers is very small. It would be a precarious undertaking to attempt stocking a high-producing herd by such a method. It always should be remembered that such bought-in cows frequently represent what some one else has discarded as useless.

The most prevalent practice, of course, is the buying of heifers at calving. Here it may be held that discards are not being bought —that it is surplus stock from the raisers. That is frequently the case; the animals have been reared specially for sale as calving heifers. This is a system carried on in all dairying countries by those who find that they are as well in pocket by raising young stock for sale as by carrying a dairy herd of their own capable of utilizing all the pasture which they possess. Stock-raisers who follow this practice do not care what sort of heifers or cows they are selling. They may, very likely, have bought the cows dry and put them on some rough pasture to eat it down. Their main object in keeping the animals was to help to turn to some advantage to themselves a piece of rough pasture which otherwise would be unprofitable. Such animals do not constitute surplus dairy stock in the true sense. They are procured and then bred to any bull—it matters not of what quality so long as he puts them in calf. Some of their progeny, again, may meet the same routine, and so the practice goes on. No progress can be made under such a system. There is no use in a farmer culling his stock if he is going to bring into his herd stuff like this. It would be much more profitable for him to do a little breeding and stock-raising himself (using good bulls, of course) than to persist in depending on the auction sale.

To raise stock on good land certainly does make them more expensive as heifers at calving, but then their cost does not represent their market value alone to the breeder. There is the added valuable knowledge of their ancestors, and their constitution and production; also the knowledge of their treatment and management as growing stock as well as their probable capabilities. The farmer has the opportunity to give them the necessary care and management that will enable them to produce and possess the constitution to do so. He can give them the start in life which is so essential, but is so frequently overlooked or even ignored. The rearing of any heifer calf or bull calf in an indifferent way will never be conducive to profitable returns. It is essential to be painstaking. As a rule dairy-farmers must select their own young stock and rear them, for improvements are never made easily.

Doubtless many a cow at present only giving a moderate yield could be greatly improved by different methods of handling, but that aspect cannot be dealt with in the present introductory article. As time and opportunity permit the various aspects of breeding, feeding, and management will be discussed in detail.

WHEAT-VARIETY TRIAL AT ASHBURTON EXPERIMENTAL FARM, SEASON 1926–27.

A. W. Hudson, B.Ag., B.Sc., Instructor in Agriculture, Christchurch.

In 1926–27 the trial of a number of varieties of wheat was made at Ashburton Experimental Farm for the third season in succession. One or two varieties previously under trial were eliminated on account of certain undesirable characters, such as weakness of straw and lack of uniformity of type.

ARRANGEMENT OF PLOTS.

A very limited area of ground was available, and the plots were arranged so as to give the maximum number of replications possible.

College Hunter's seed from the previous trials was again used as a standard with which the other varieties were compared. Six replications of the varieties were sown, every third plot throughout being sown with College Hunter's. This arrangement brought the standard variety immediately alongside each plot of the other varieties. Designating the College Hunter's by "*C.H.*" and the other varieties as "V. 1," "V. 2," &c., the following example, using three varieties, illustrates the lay-out :—

V. 1—*C.H.*—V. 2—V. 3—*C.H.*—V. 1—V. 2—*C.H.*—V. 3—V. 1—*C.H.*, &c.

In all, 118 plots were sown in this way. Each plot was one width of a seven-coulter drill, and separated from its neighbours by 14 in. spaces (see Fig. 1). The method of sowing was as described in the *Journal* for July, 1926, p. 6, under heading of "Cereal Manuring Experiments."

SEEDING.

Again seeding was done so as to give as nearly as possible the same number of seeds per acre for each variety. This was done as in previous years by weighing a large number of 100-grain samples, calculating their mean weights, and then estimating the weight of each variety required to give the same number of seeds as 1½ bushels of College Hunter's. An amount as near as practicable to the quantity thus calculated was sown.

METHOD OF HARVESTING.

Each plot was divided into four subplots each 36½ yards in length. All but five varieties ripened before the standard variety (see table), and had to be cut with reaphooks. The remainder were cut with the reaper-and-binder.

Reasonable care was taken to keep varieties pure, although a little mixing is of no consequence, as, in addition to the comparative yield trial, several of the varieties were grown in "increase" plots which were carefully rogued and every care taken to keep them pure during and after harvesting.

The yields, &c., are shown in the table on page 316.

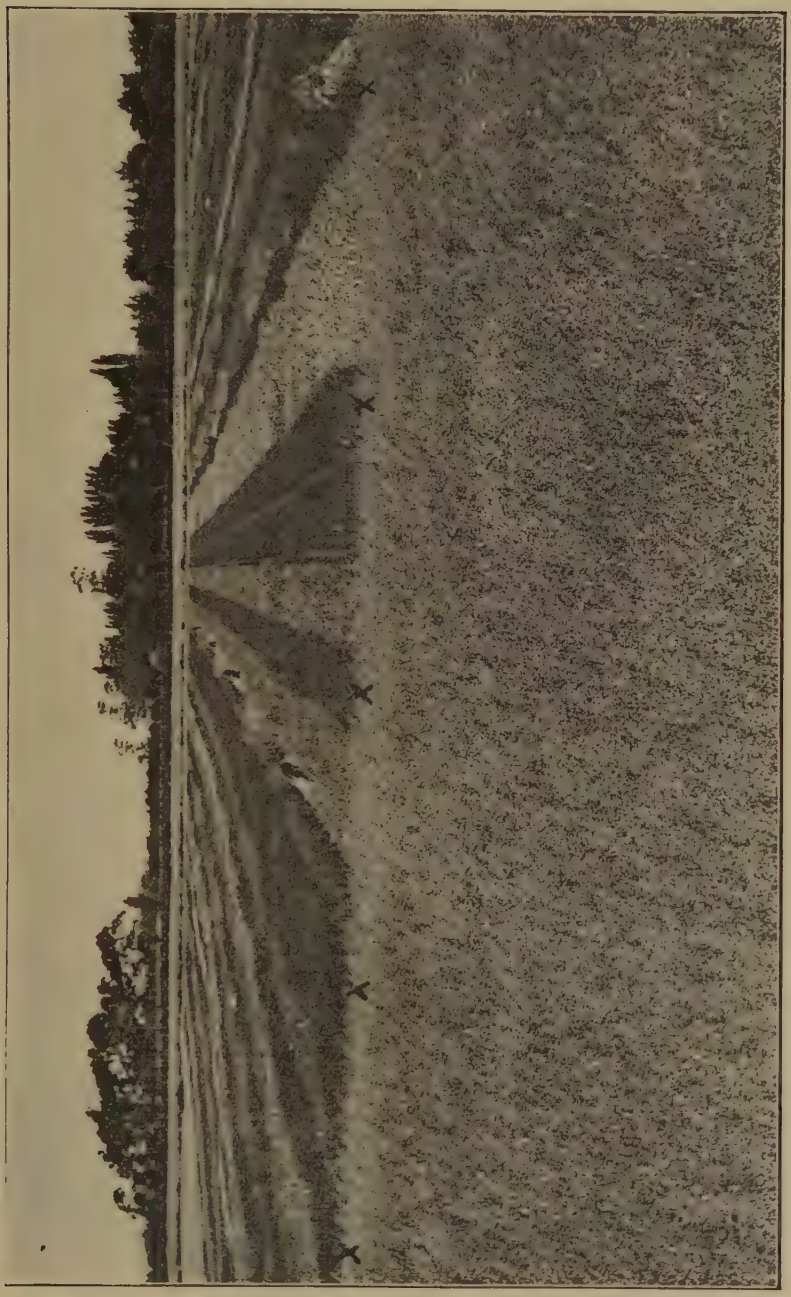

FIG. 1. PORTION OF THE WHEAT VARIETY PLOTS AT HARVEST-TIME IN JANUARY, 1927. (OAT CROP IN FOREGROUND.)
The College Hunter's plots are marked by crosses. Some of the early-ripening varieties, cut by hand, are seen in stook.
[*Photo by the Writer.*

Yield of Wheat Varieties at Ashburton Experimental Farm, 1926-27 Season.

Variety.	Number of Paired Plots.	Yield per Acre.		Difference in Favour of Variety (+) or College Hunter's (−).	Difference Significant (S.) or Non-significant (N.S.).*	Date of Ripening of Variety in January, 1927.†	Difference in Favour of Variety (+) or College Hunter's (−) in Preceding Seasons.	
		Variety.	College Hunter's.				1924–25.	1925–26.
		Bushels.	Bushels.	Bushels.			Bushels.	Bushels.
Major	20	47·9	39·3	+8·6	S.	20th	+5·5	−4·9
Solid-straw Tuscan	21	45·9	38·8	+7·1	S.	27th	No plot	N.S.
Queen Fair	14	44·4	39·7	+4·7	S.	20th	+4·5	−6·9
White-straw Tuscan	20	42·9	39·3	+3·6	S.	25th	+9·0	−2·3
(X) Velvet x Solid-straw Tuscan‡	23	39·7	36·4	+3·3	S.	26th	No plot	No plot.
Marquis	21	41·5	38·7	+2·8	S.	21st	+2·9	−3·2
Goldberry	23	39·7	37·3	+2·4	S.	31st	No plot	N.S.
College Velvet	21	40·7	39·7	+1·0	N.S.	26th	No plot	N.S.
Trifolium 14	22	37·8	37·3	+0·5	N.S.	31st	No plot	No plot.
Red Fife	22	38·8	38·4	+0·4	N.S.	21st	+5·7	−1·7
Essex Conqueror	20	38·1	38·9	−0·8	N.S.	31st	−5·0	N.S.
Yeoman II§	19	33·0	38·1	−5·1	S.	31st	No plot	No plot.
College Hunter's (direct from College)‖	20	39·5	39·9	−0·4	N.S.	31st	Standard variety	Standard variety.

* A difference is regarded as significant only when the chances are 30 to 1 or greater in its favour. † The standard variety (College Hunter's) ripened on 31st January. ‡ This variety, which appears to be a cross between Velvet Chaff and Solid-straw Tuscan, was found as an impurity in another variety by Mr. F. E. Ward (now Director of Agriculture, Tasmania); it is considered by some authorities to be McCallum's Velvet, a variety once grown to some extent in Canterbury. § Yeoman II was grown from seed imported direct from England, and came to the Department of Agriculture through the courtesy of Dr. Hilgendorf; the germination was poor, no doubt accounting for low yield. ‖ See under subheading "Origin of Seed Trial" (page 318).

COMMENTS ON THE TABULATED RESULTS.

In the 1926–27 season seven varieties have proved superior in yield to College Hunter's to a significant extent; five varieties equal College Hunter's, or at least do not differ from it significantly; and one (Yeoman II) has proved decidedly inferior. The Yeoman II replaced Yeoman I of the trials of previous seasons, and suffered a severe handicap on account of very poor germination in its first season in New Zealand. Hence its poor yield must not be regarded as representative.

The season 1925–26 was an unusual one in that the winter was extremely wet. The whole crop, being in a paddock which poached very badly, was extremely poor, the yields ranging from 7·7 to 15·2 bushels per acre on different plots. Certainly the College Hunter's showed its ability to withstand extremely bad conditions better than most of the other varieties.

Four of the varieties shown in the table showed no significant difference from the standard, while all the remainder were decidedly inferior. The varieties Major, Queen Fair, White-straw Tuscan, and Marquis, which in 1924–25 and 1926–27 yielded so much better than College Hunter's, did very poorly in the 1925–26 season.

The 1924–25 season's results showed a marked resemblance to those of 1926–27. The two varieties which have been most erratic in behaviour are Red Fife and Essex Conqueror. The former out-yielded Hunter's in the 1924–25 season by 5·7 bushels, but does not differ from it in the 1926–27 season. The latter has advanced from a yield of 5 bushels less than Hunter's in 1924–25 to one practically equal to it in 1926–27.

FIG. 2. PORTION OF THE WHEAT VARIETY PLOTS IN EARLY STAGE BADLY ATTACKED BY GRASS-GRUB.

Plots so affected were not taken into account in calculating yields. Photo taken on 13th October, 1926.

[*Photo by the Writer.*

Origin of Seed Trial.

The question was raised as to whether seed from a crop yielding about 15 bushels per acre would be as satisfactory as that from a 40-bushel crop. Dr. F. W. Hilgendorf, of Lincoln College, was of opinion that both samples would prove equally satisfactory, and a double trial was decided upon. A sample of the line of College Hunter's used as the standard in the Ashburton variety trial which had been two seasons removed from Lincoln College and yielded 15 bushels per acre in the 1925–26 season was tried at Lincoln College against College Hunter's which had yielded 40 bushels per acre at Lincoln in the 1925–26 season. Correspondingly, a sample of the latter was transferred to Ashburton and included in the variety trial. As will be seen in the table, there was no significant difference in yield between the two.

Dr. Hilgendorf reports on the College trial as follows: "Comparison was made between twenty-three paired plots. Mean of College seed plots, 33·6 bushels per acre; mean of College Ashburton seed plots, 34·7 bushels; difference, 1·1 bushels. Odds in favour, 16 to 1 (non-significant). The total superiority of all the Ashburton seed plots over all the College seed plots was 27 bushels. In one pair of plots the difference in favour of the Ashburton seed was 13 bushels per acre. This single plot accounted for almost half the increase, and suggested an error in threshing or weighing, or a gross irregularity of soil. If this single plot was left out half the superiority of the Ashburton seed would disappear, and in any case it is non-significant."

The excellent work of Mr. J. G. McKay in the drilling of the plots is evident in the photographs. His valued assistance, and that of others mentioned in a previous article, was largely responsible for the success of the work as a whole.

BLISTER DISEASE OF APPLES.

An investigation was made by the Biological Laboratory into the causes of an obscure disease that made its appearance last season in certain parts of the Motueka fruitgrowing district the blister disease of apples. The annual report on the work of the Laboratory states that although the lesions which occurred in the fruits showed the presence of a fungus—Coniothecium—this parasite was found to be of merely secondary importance. Certain physiological irregularities had been brought about by unfavourable soil conditions, weather conditions, and orchard management. After closely examining the circumstances in which affected trees were to be found, the conclusions reached were that the rooting-systems were feeble through shallow rooting due to an impenetrable pan, through root-injury in cultivation, and through lack of drainage. The remedy recommended was to raise the vigour of the trees by various means, such as drainage, manuring, thinning, hard pruning, &c., according to the circumstances involved. Another non-parasitic disease brown-core of apples—which showed itself in the form of brownish masses variously distributed in the pith and cortex of apple fruit, was ascribed to similar causes, and was probably precipitated by the unusual weather conditions that preceded its appearance. There is little doubt also that the dying-back of Delicious and Sturmers that was unusually prevalent in this season was due to similar causes. There is no doubt that this investigation uncovered a group of conditions that have been insidiously operating against the orchardists on a very considerable area of country.

OPEN FERN-LANDS OF THE KING-COUNTRY.

NOTES ON THE ARIA CO-OPERATIVE TRIAL BLOCK, 1926–27.

J. E. F. JENKS, N.D.A., Instructor in Agriculture, Te Kuiti.

FIELD trials in connection with grassland must necessarily be of a more prolonged nature than those with annual crops, and the attainment of reliable results is a matter of several years' work. The trials at Aria, though they have included some useful work with fodder crops, are located in a district where every farmer is primarily a grassland farmer. Consequently the value of these trials lies in the accumulated observations of several years' work in the formation and treatment of pastures rather than in any one season's results. (Previous articles on the work at Aria have been published in the *Journal* for March, 1925, and September, 1926.)

CROPPING.

The past season saw the close of the cropping. The flat (Fields A and B) was ploughed in November last, and sown on 7th December with millet mixtures. Earlier sowing would have been preferable, but was not possible owing to the waterlogged nature of this particular area. Four ½-acre plots were sown as follows:—

(*a*) Japanese millet 16 lb., cow-grass 4 lb., per acre; cost, 7s. 4d.

(*b*) Japanese millet 12 lb., black barley 1 bushel, per acre; cost, 12s.

(*c*) Japanese millet 20 lb. per acre; cost, 3s. 4d.

(*d*) Japanese millet 12 lb., Hickory King maize 1 bushel, per acre; cost, 12s.

Manure, 2½ cwt. 44/46 super per acre.

Grazing was commenced on 14th January, and continued at intervals throughout January, February, and early March. The crop maintained the flow of milk and probably left a profit. An acre of millet costs for seed, manure, and labour about £2 10s., and will provide succulent supplementary feed for at least five cows for two months at a time when it is important to arrest the natural tendency for the flow of milk to decrease. An extra 8 lb. of butterfat per cow (1 lb. per week) covers the cost of the crop. It is always advisable to sow in two portions and graze alternately. Of the four plots, (*a*) and (*c*) were the best as well as the cheapest; (*a*) is a useful mixture when the land is not required for cropping until the following spring, as it checks weeds and provides some good autumn feed. The black barley made a poor showing; the millet is too strong a competitor during the warmer weather. The maize was well eaten, but was very thin owing to the seed being imperfectly covered.

Field L, where the lucerne failed, was ploughed and worked for swedes in December. Unfortunately, drilling was delayed till 14th January, and the fly played havoc with the young plants. Experience this season in the King-country was that early drilling (10th to 20th December) gave the best results. A number of plots were sown: Superlative, Bell's Mervue, Best of All, Bell's Improved Bronze-top,

Crimson King, Prima Donna, Sharpe's A1, Sharpe's Ne Plus Ultra, Danish Giant, Bangholm, and Studsgaard. Manure was 1 cwt. basic super and 1 cwt. bonedust per acre (the lucerne had been top-dressed in September).

On the whole no variety showed definite superiority over the Superlative; the crop was not good enough for weights to have any significance, though some good individual roots were grown. Bangholm, a white-fleshed Danish swede with a top resembling a soft turnip, grew fast and showed great promise, but started to decay early in July; for early use this variety may prove useful. Chou moellier was a good crop, but thousand-headed kale gave as much feed and seemed to be preferred by the cows. A mixture of Italian rye-grass and subterranean clover showed good promise as a catch-crop for early spring use. The hay and roots were fed out on Field J, which should help that paddock considerably.

NEW GRASS.

After the millet in Fields A and B (the flat) was finished, the land was ploughed, worked, and sown to permanent grass with 3 cwt. 44/46 super and 1 cwt. blood-and-bone per acre. There are eight ¼-acre plots, as follows:—

Pasture Species.	Plots 1, 4, and 7.	Plot 2.	Plot 3.	Plot 5.	Plot 6.	Plot 8.
	lb.	lb.	lb.	lb.	lb.	lb.
Italian rye-grass ..	4	4	4	4	8	10
Perennial rye-grass ..	12	12	8	15	12	12
Cocksfoot (Akaroa) ..	8	..	14	..	..	..
Crested dogstail ..	1	1	3	1	1	..
Timothy	2	2	1	3	2	4
Meadow-foxtail ..	2	2	..	4	1½	..
Meadow-fescue ..	..	10	..	..	..	..
Poa trivialis	½	½	..	1	½	..
Paspalum (Australian) ..	..	..	..	..	5	..
Cow-grass	3	..	3	3	3	3
Alsike	..	3	..	..	..	..
White clover	1	1	1	1	1	1
Subterranean clover ..	½	½	½	½	1	1
Prairie-grass	..	..	..	..	..	1*
Total seeding per acre ..	34	36	34½	32½	35	31†

* Bushel. † Excluding prairie-grass.

Each plot cost approximately £1 14s. per acre for seed. This area was sown late in March. The young grass started well, but the continuous wet during the past winter inflicted serious damage in the lower-lying places.

Field L was sown this spring with a paspalum-rye-clover mixture.

PASTURE NOTES.

The plots in Field M continue to be remarkably even as far as appearance is concerned. Even the "cheap" mixture on Plot 1 (rye-cocksfoot-clover) is making a good turf. The danthonia on Plot 3 is just visible in places, but is overshadowed by the stronger-growing species. Plot 4 (no cocksfoot) is always closely grazed and shows

distinct promise; it may well be that under regular top-dressing and rotational grazing a permanent sward of rye, timothy, and dogstail can be maintained even on this light country. This field was top-dressed in August, 1926, with 3 cwt. 44/46 super, and cut for hay in January, 1927. At other times it has been grazed at intervals by dairy cows.

The plots in Field F are doing well. Paspalum is gradually taking charge of Plot 1, where Chewings fescue has done only moderately and red-top is hardly to be found. Brown-top and dogstail are doing well on Plot 3. The kikuyu on Plot 2 made good progress last summer, but its long dormant season (May–October) is against it here. Imported wild white clover has done fairly well.

FERTILIZERS.

Potash was tried last season in conjunction with the regular top-dressing of super. Plots of 30-per-cent. potash were sown in Fields J and M at the rate of ½ cwt. per acre, and kainit in the same paddocks at the rate of 1 cwt. per acre. In Fields E and F, where there is always a certain amount of bracken-fern, strips of kainit were sown at the rate of 2 cwt. per acre. At no time was there any visible benefit, nor did stock show the slightest preference for the potash plots.

In this locality super apparently gives no better results on limed plots than on unlimed. It is reasonable to suppose that basic super or lime and super should be better manures than super straight, but there is no evidence in support of this theory. One can only conclude that readily available phosphates are the outstanding requirement and are the only class of fertilizer profitable to use, at least as far as top-dressing is concerned.

REGRASSING METHODS COMPARED.

Prior to 1921 the whole area (except the flat) had received the same treatment, having been sown to grass in 1905 after turnips and never top-dressed. In 1920–21 Fields L, M, and F were ploughed, turnipped, and sown to temporary pasture. In 1923 cropping was recommenced in these paddocks, and the reclamation of the old pasture in Fields J and E was commenced. This old pasture at that time consisted (on visual inspection) of fog and cocksfoot, with some Poa pratensis, danthonia, and suckling-clover, together with scattered bracken-fern and Strathmore weed. It was typical of thousands of acres of semi-deteriorated open-country pastures in South Auckland.

Fields J and M afford the first comparison. Both are more or less undulating. At the outset Field J was in rather better condition than Field M; it has a slightly better soil, and had been used by stock as a camp. Manures are calculated at to-day's prices plus freight and cartage.

Field J (2¾ acres):—Costs from 1923: October, 1923, super, slag, and lime, £3 2s. 6d.; July, 1924, slag, £2 12s.; May, 1926, seed for patch-sowing, £1; August, 1926, super, 30-per-cent. potash, and kainit, £2 13s. 6d.; harrowing, sowing manure, mowing, and raking fern, £4: total, £13 8s., or £4 17s. 6d. per acre.

Field M: It is allowed that the value of the crops grown—turnips, millet, and oats—paid for the seed, manure, and labour expended

on them—a conservative estimate. Costs since 1923 are as follows: Autumn, 1925, ploughing, working, and sowing, £4; seed and manure, £6 7s.; August, 1926, super, 30-per-cent. potash, and kainit, £2 8s.; harrowing and sowing manure, £1: total, 13 15s., or £6 17s. 6d. per acre.

Thus Field M has cost £2 per acre, or approximately 40 per cent., more than Field J, but there is no question as to their relative quality. The pasture in J has certainly shown great improvement, but response has been slow, and the turf is still far from being first-rate. It is barely up to dairying standard; the cows are not fond of it. Field M would be considered good even in the best parts of the Waikato. It cut over 2½ tons of hay per acre, and the cows will break fences to get into it. Admittedly, it is still young, but the bottom is steadily improving; every ounce of manure now applied to it will benefit good grasses and clovers, while half the manure applied to J is still going on to weeds, bare ground, and low-grade plants such as fog and suckling-clover. Bracken-fern is still troublesome in J; it has disappeared in M. The pasture in M is worth at least twice as much to the farmer as that in J; it has certainly not cost twice as much to obtain. Unquestionably, it has paid to plough in this case.

Fields E and F are a parallel case. Field F was sown down after cropping in September, 1924; spring sowing let the fern away, and though it is now well in hand autumn sowing would have been preferable. Costs since 1924:—

Field E (1½ acres): July, 1924, slag and basic super, £1; May, 1926, basic super and kainit, £1 13s.; May, 1926, seed for resowing, £1; cutting fern and sowing manure, £1 10s.: total, £5 3s., or approximately £3 9s. per acre.

Field F (1 acre): Spring, 1924, ploughing, working, and sowing, £2; spring, 1924, seed and manure, £3; August, 1926, super and kainit, £1 5s.; harrowing and sowing manure, 10s.: total, £6 15s.

Both paddocks are rather steep and only just ploughable; in fact, one would hesitate to plough. However, the top-dressing of old run-out grass in Field E has been disappointing; even surface-sowing in conjunction with the manure has not been wholly satisfactory. Certainly the pasture has improved, but the original grass was too far gone to respond, except, of course, in those places where the fern had been kept in check. On the other hand, the cropping and ploughing checked the fern in Field F, and an opportunity was afforded for the establishment of a good sole of turf-forming species such as paspalum, brown-top, and Lotus major. Field F responds well to fertilizer and is closely grazed by the stock; it is worth fully twice as much per acre as Field E, where the grass still occupies less than half of the ground and a constant war must be waged against weeds and fern. This does not mean to say that all pastures must be ploughed before they can be regenerated, but it is evidence that where pastures on ploughable land have seriously deteriorated it is sound policy to plough and regrass first.

Ophthalmia (Temporary Blindness) in Sheep.—This complaint was reported as rather common in the Wairarapa, Stratford, and Marlborough districts during the past year. Investigations in progress at the Wallaceville Veterinary Laboratory suggest that the disease is contagious.

FARMERS' FIELD-CROP COMPETITIONS.

AUCKLAND PROVINCE, SEASON 1926–27.

J. W. WOODCOCK, N.D.A., Assistant Instructor in Agriculture, Auckland.

FARMERS' field-crop competitions were continued during the 1926–27 season at Otorohanga, Whangarei, and Mauku, and new competitions were established at Elstow (Te Aroha), Te Kowhai, and Cambridge. Although the excessively wet weather last spring was detrimental to good cultivation in the early stages of growth, the subsequent results obtained were highly satisfactory. Altogether sixty-two crops were judged, of which thirty-eight were mangolds, five carrots, eleven swedes, six soft turnips, and two chou moellier.

The judging was carried out at Mauku by Mr. T. H. Patterson, Instructor in Agriculture, and at the other centres by Messrs. Hamblyn, Jenks, Wild, and the writer, all of the Fields Division. In most cases farmers turned out in fairly large numbers to see the crops judged. A display of cups, trophies, and roots from winning crops was staged at the Waikato Winter Show, the exhibits being described by cards giving full particulars of origin and cultural methods.

At the various centres which have been holding competitions for the past two or three years the average yield of roots is steadily increasing and the standard of cultivation has improved. Moreover, farmers, by accompanying the judges, themselves gain useful knowledge by observing other crops and the conditions under which they were grown.

MANGOLDS.

The mangold crop is the most popular one from the competitive point of view, because it is one that responds to care and cultivation; and since a comparatively small area is grown on the farm it is a crop in which the farmer generally takes special pride.

The following particulars, giving the yield per acre at three centres, show how the average of the first three winning crops at each centre has been increased:—

	1924–25.	1925–26.	1926–27.
Mauku	53 tons	60·5 tons	61·5 tons.
Otorohanga	..	66 ,,	66·6 ,,
Whangarei	..	42 ,,	57 ,,

The various competitions in 1926–27 were won as follows:—

Mauku: R. K. Membery, Patumahoe; Prizewinner Yellow Globe variety, 71½ tons per acre.

Otorohanga: H. A. Lurman, Otorohanga; Prizewinner, 81 tons per acre.

Whangarei: J. Breslin, Titoki; Long Red, 64 tons per acre. This is Mr. Breslin's second win in succession, and he gained both first and second places in this year's competition.

Te Kowhai: A. G. Porter, Te Kowhai; Jersey Queen and Yellow Globe, 59·6 tons per acre.

Varieties.—The Prizewinner variety is rapidly displacing the once popular Long Red, especially on the volcanic soils and light loams, although Jersey Queen has a wide popularity, especially in Waikato.

White Sugar is growing in favour. This variety has a higher sugar and dry-matter content than any other variety, besides being a heavy cropper, and it is probable that if points were given for feeding-value as indicated by the sugar content the White Sugar mangold would hold its own in popularity with any other. The Long Reds grown in the competitions were inclined to become hollow after the bulbs had attained a fair size.

Manuring.—One of the most outstanding features of the competitions was the response to organic manures. At Otorohanga the winning crop was given 4 cwt. of fish-manure in addition to cowyard manure; the second crop had liquid pig-manure, while the third was grown on a heavily dunged soil. At Mauku the winning crop received 5 cwt. of 30-per-cent. potash salts only, but it must be realized that this followed an early potato crop which was manured with about a ton of a mixture half of which was bonedust. Moreover, it had previously had a good deal of dung. The need for organic manures for the mangold crop on the lighter soils is apparent, and this fact has often been demonstrated in the past, especially where the crop is not taken after grass. Some of the best crops were top-dressed with nitrate of soda, which is good practice if done early enough. Most of the competitors realized the need for salt and potash.

Spacing.—This was the greatest limiting factor. Some well-cultivated crops lost tonnage in this way, while other crops not so well cultivated gave heavy yields. The rows should be just wide enough to allow the crop to be intercultivated with fair ease, and 24 in. to 26 in. apart is quite a suitable distance, varying, of course, with the variety grown.

Previous Cultivation.—This is a most important factor on volcanic soils with a poor moisture-holding capacity and a low humus content. The first ploughing, especially if the crop is taken after grass, should be early, in order to allow the vegetable matter to become well incorporated with the soil. The winning crops were all well cultivated both before and after the seed was sown, and the first ploughing was done in June and July.

Amount of Seed and Time of Sowing.—These factors varied considerably, but it would appear that a fairly heavy seeding—from 6 lb. to 8 lb. per acre—gives the best crops. The practice of sowing the seed in special beds and transplanting the young plants is becoming a popular one in Auckland Province. The labour required for this method is probably not much more than is needed for singling, since in most cases the plants are put in with the aid of the plough. The ground can be given much extra cultivation before the planting-out is done, just at the time when annual weeds are most vulnerable. Further, where grass-grubs and caterpillars are bad this method is again of advantage in that the larger plants are not generally attacked. Most of the crops not grown in this manner were grown on the ridge, but it is doubtful whether ridging the land pays if the land is fairly clean, unless it is done on heavy land with plenty of moisture. The date of sowing varies according to the district: late October is suitable for the North, but the middle of November appears quite early enough for South Auckland.

After-cultivation.—This is one of the most important factors in the production of a heavy crop, yet it is one that is too often overlooked, and the particulars of cultivation after the crop was sown are often omitted from the entry form as if it were a fact too trivial to mention. Yet all the winning crops were well cultivated, most having been horse-hoed five or six times. In order to produce 80 tons of a crop containing at least 60 tons (probably more) of water, it is essential to conserve as much soil-moisture as possible, and this can be done only by keeping the surface well cultivated during growth of the crop.

In all competitions the initial entries were large, but during the course of the season many withdrawals were made for various reasons. It must be impressed on farmers that the chief aim of the competitions is to get at the reasons for the failures, as well as the methods employed by the successful growers, and it is the knowledge to be gained as much as the prize to be won that should produce the greatest effort.

CARROTS.

The carrot crops judged showed a marked improvement on those of the previous year. Two competitions were held, one at Whangarei and the other at Otorohanga, but at the latter centre only one entry was received. This was an excellent crop of White Belgians, yielding 41 tons per acre, grown by E. Langkilde, Otorohanga. The Whangarei competition was won by H. Crane, Ngaratunua, with a crop of 42 tons per acre of White Belgians, a variety which predominated in the competition. From 2 lb. to 3 lb. of seed per acre, sown in 14 in. drills, gave the best results, but under these conditions the hand-hoe only can be resorted to. The chief fault noticed with the crops in this competition was the neglect of proper thinning in the rows.

SWEDES.

Two competitions were held, one at Otorohanga and the other at Elstow. The former was won by Mr. J. Sing, Otorohanga, with 60½ tons per acre, while Mr. W. T. Dale, Waihou, carried off the honours at Elstow with a crop of 43·4 tons.

Superlative was the variety most used, and it proved to be an excellent one for both districts. Basic super or super and lime appear to be quiet adequate for manuring, but there is a tendency to use too little. On the lighter soils a proportion of bonedust, up to one-third or one-half of the mixture, might be added with advantage. Most crops were grown in 12 in. or 14 in. rows without after-cultivation; it has been found that ridging or the use of wide rows reduces the yield per acre, and intercultivation does not appear to be payable. The rate of seeding was invariably 12 oz. per acre.

SOFT TURNIPS AND CHOU MOELLIER.

One competition for soft turnips was held at Elstow, the winner being Mr. A. Davey, Te Aroha, with 28½ tons per acre of the Green Globe variety.

The only competition for chou moellier was won by Mr. J. Fortune, Otorohanga, with a yield of 27 tons per acre.

GENERAL.

In all the competitions the interest taken by farmers and the results obtained were excellent, considering that many of the competitors are breaking in new country. Substantial prizes were donated by a number of interested individuals and firms. The judges desire to record their gratitude to the various committees for the arrangements made in connection with the judging of the crops. At most centres the practice of having a gathering of farmers in the evening when presenting the prizes is popular, and the social side receives due consideration.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

TARANAKI AND WANGANUI DISTRICTS COMPETITIONS, SEASON 1926–27.

J. M. Smith, Instructor in Agriculture, New Plymouth.

Competitions similar to those of preceding years were conducted in the North and South Taranaki and Wanganui districts during last season. Root-growing was carried out in all three districts, while calf-rearing competitions were operated in both the Taranaki centres.

CALF-REARING.

The work of this branch was marked by a very substantial increase in the number of entries, and also by a decided improvement in the quality and condition of the calves brought forward for judging. There is little doubt that the work of the past few years is now being reflected in the quality of the animals reared, and the matter of judging becomes more difficult each season. There are two distinct classes—the Jersey-Ayrshire cross and the Friesian-Shorthorn cross, or a light breed and a heavy breed—and in both of these classes there are two distinct competitions—one for condition and one for dairy type. It may appear to some that undue importance is being attached to condition, and that dairy type is being left in the background, but it must be remembered that the competition is primarily one for rearing the calf and not for the selection of calf or dam. While the importance of type is fully recognized, the fact remains that if a competitor can successfully rear a calf showing little or no type it naturally follows that he or she can rear a "typey" calf just as well.

In the season under review the points for chart were reduced to 25, and an additional 25 marks were given for knowledge displayed in connection with the feeding and general management of calves. Although the factor of cost is now eliminated as far as awarding points are concerned, the competitors are still required to state the actual cost of feeding. The average cost per head for the season was £1 8s. for North Taranaki and £1 6s. for South Taranaki. The entries numbered 117 and 283 respectively for these centres.

Judging was carried out during December, and, as usual, the judges gave demonstrations at each of the schools visited, losing no opportunity of driving home essential facts in connection with calf-feeding. In South Taranaki all group winners are brought to a centre for championship judging, and this took place at Eltham.

This is far the best method of finally selecting the champions, and an endeavour is now being made to reinstate the system in North Taranaki, where it was dropped a year or two ago on account of cost.

In North Taranaki the championship for the Jersey-Ayrshire cross was won by Kathleen Looney, of Koru, who also scored the highest number of points for type in this class. For the Friesian-Shorthorn cross Keitha Patterson, of Kaimiro, brought forward the animal which was finally placed champion, and again this calf scored highest for type. In South Taranaki the champion Jersey-Ayrshire was reared by L. Brown, of Douglas, while the champion Friesian-Shorthorn was won by J. Foreman, Tawhiti. The specials for dairy type in this district were won by E. Sheenin (Auroa), E. Jones (Manaia), B. Green (Okaiawa), and L. Gernhoefer (Rawhitiroa) for the Jersey-Ayrshires, and J. Johnston (Hawera), M. Jones (Finnerty Road), L. Brown (Douglas), and H. Hammonds (Opunake) for the Friesian-Shorthorns.

ROOT CROPS.

The season was not a good one for root crops, particularly in Taranaki. A wet spring delayed sowing considerably, many of the plots not being sown until after the first week in December.

The crops and varieties grown in the different districts were as follows: North Taranaki—Mangolds, Prizewinner and Long Red; carrots, Holmes' Improved and Matchless White. South Taranaki—Mangolds, Red Intermediate; carrots, Barriball. Wanganui—Mangolds, Prizewinner; carrots, Matchless White. It will be noticed that two varieties of both mangolds and carrots were tried in North Taranaki. This departure towards experimental work was not so much to actually test the varieties as to endeavour to create further interest by the competitors and their parents, and in this it was successful. The grouping in North Taranaki was also altered in an endeavour to confine the poorer soils to one group, the better soils to the next group, and so on; but, while the new groups are certainly an improvement, anomalies still exist.

The failure of a number of plots to see the season out is still a matter of concern. By far the biggest factor in reducing the number of plots for judging is the intrusion of stock, and we again bring this matter under the notice of the parents. It is very disheartening to the young competitor to put in much work and care on a plot only to have it destroyed a few days before judging. The proportion of crops presented for final judging in the different districts was—South Taranaki, 57·4 per cent.; North Taranaki, 60 per cent.; Wanganui, 68 per cent.

The placings for the championships were as follows, the places named referring to schools in each case:—

		Tons	cwt.
North Taranaki:—			
Mangolds:	1st, R. Thomas, Tataraimaka	114	11
	2nd, V. Penwarden, Tataraimaka	107	12
	3rd, D. Graham, Waitara	113	16
Carrots:	1st, J. Moffit, Warea	66	13
	2nd, T. Western, Bell Block	42	0
	3rd, J. Thomason, Egmont Village	40	0

Best-kept plot: R. Burrows, Vogeltown.

		Tons	cwt.
South Taranaki :—			
Mangolds :	1st, G. Putt, Otakeho	124	11
	2nd, W. Laursen, Okaiawa	108	0
	3rd, B. Laursen, Okaiawa	105	8
Carrots :	1st, Una Glynn, Ohangai	65	14
	2nd, N. Walker, Okaiawa	67	6
	3rd, R. Taylor, Ngaere	62	3
Best-kept plot :	L. Gernhoefer, Rawhitiroa.		
Wanganui :—			
Mangolds :	1st, C. Morrison, Turakina	119	17
	2nd, S. L. Harris, Bull's..	123	5
	3rd, A. Blake, Waverley	117	12
Carrots :	1st, A. Blake, Waverley	69	9
	2nd, G. Hamlyn, Kakaramea	70	14
	3rd, L. Stewart, Ngaturi	65	8

It will be noticed that in some instances the winner's crop was actually lighter than that of the second placed competitor ; in these cases the competitor with the heaviest crop has lost points probably on chart.

The usual exhibits were again staged at the New Plymouth, Hawera, Wanganui, and Wellington winter shows, and were the object of much favourable comment.

Senior Boys' and Girls' Clubs.

With a view to sustaining and extending the interest in the movement, and as a means of continuing the instruction over that period between the junior clubs and the farmers' competitions, senior clubs were organized last season in South Taranaki. Cropping was the activity taken up ; the area to be grown was fixed at $\frac{1}{4}$ acre, the crops selected being carrots and mangolds. Further, for the purpose of creating additional interest and for instructional reasons it was decided to embody a manurial trial in the competition. For this purpose a standard manure consisting of three parts super, one part bonemeal, and one part Nauru phosphate was supplied ; in addition half the plot was treated with sulphate of potash at the rate of 1 cwt. per acre, and the other half with salt at the rate of 3 cwt. Certain instructions with regard to cultivation, sowing, &c., were supplied, but width of drills was left to the discretion of the competitor. Charts were also supplied on which such information as description of soil, details of cultivation, total cost of cultivation, &c., were to be recorded. The points fixed for judging were as follows : Yield, 2 for every ton ; cultivation, 10 ; quality, 10 ; chart, 15. Twenty-three entries were received, and eighteen of these completed the season's work.

The placed competitors were as follows :—

		Tons	cwt.
Mangolds :	1st, W. Dakers, Manaia	73	7
	2nd, R. Harding, Ohangai	76	6
	3rd, L. Symes, Auroa	64	8
Carrots :	1st, R. Wallis, Okaiawa	61	10
	2nd, R. Corbett, Awatuna	57	8
	3rd, B. Taylor, Ngaere	48	7

With regard to the manurial trial it is interesting to record that the average yields of the crops where salt and potash were used were as follows : Mangolds—Standard mixture and potash, 45 tons 3 cwt. ; standard mixture and salt, 51 tons 8 cwt. Carrots—Standard mixture and potash, 42 tons 15 cwt. ; standard mixture alone, 38 tons 14 cwt.

WAIMAUNGA EXPERIMENTAL FARM, 1926-27.

C. S. DALGLIESH, Fields Instruetor, Greymouth.

THE season of 1926–27 was a most unsatisfactory one for the Waimaunga Experimental Farm (Grey Valley). Frequent floods disorganized farm operations and made experimental work ineffectual, besides damaging land and fences. These conditions, of course, affected the dairy herd, and returns suffered in consequence. Twenty-eight cows came in at the commencement of the season, and late calvers increased the number to thirty-two. The average yield of butterfat per cow for the season was 232 lb., compared with 245 in 1925–26.

It was found necessary to dispose of the flock of eighty breeding-ewes, which realized good prices at auction sale. One truck-load of lambs—Border Leicester-Romney cross—was sent to Addington and sold well. They were on the big side for freezing purposes, but were very fine lambs for the local trade.

FAT LAMBS SENT TO ADDINGTON SALE.

As mentioned in last year's report (*Journal*, September, 1926) the grazing of pigs gave good indications for pasture-improvement. To gain further information on this matter it was intended to fence off small areas and graze pigs for a certain period, and note if conditions of improvement were maintained and were worthy of following up. Owing to the difficult conditions it was impossible to fully carry out this plan, but so far as it went a better pasture constituent resulted than by artificial top-dressing alone, and further experimental work along these lines is now in progress. Cocksfoot responded to the treatment very markedly. Summed up briefly, the indications regarding pastures on land of the Waimaunga class are (1) that without lime and phosphates the result is of little value; but, (2) where lime and phosphates have been used in establishing the pasture, or where top-dressing has been done with phosphates and nitrogenous

manures (on ground previously limed), the grazing of pigs will improve the pasture to an easily noticeable extent; moreover, stock show a preference for this pasture.

The field-crop experiments undertaken included several in the control of swede and turnip diseases, also tests in the manurial top-dressing and liming of pastures, and sundry rotational trials, &c. As already indicated, however, the severe floods experienced either completely destroyed experiments or made accurate work and recording impracticable, and it has therefore been decided not to attempt publication of any details on this occasion.

TURKEY-RAISING.

F. C. Brown, Chief Poultry Instructor, Wellington.

Success in turkey-raising depends largely on having the right class of land for the birds to run on. Turkeys do best on fairly high, sloping country that grows tussock-grass and the like, or on flats where the soil is of a free sandy loam with good natural drainage. On low-lying, heavy, damp ground it will generally be found a difficult matter to rear the young stock, especially during a wet season when there is a heavy growth of grass.

Having suitable soil and a generally favourable environment, the next great essential is the quality of the breeding-stock. There must be no doubt whatever as to their constitutional vigour. Birds that have been late hatched or stunted in growth should never be used for breeding, for, if so, trouble is almost sure to be experienced in rearing the young stock. It is a common but mistaken practice to use all or any members of a flock for breeding-purposes. A vigorous strain can only be built up and maintained by careful selection of the strongest specimens for renewal of stock.

It is also important that the stock are not inbred. Breeding from birds that are too closely related is probably more responsible for mortality in young turkeys than any other cause. If turkeys are to have the power to resist the many troubles and diseases to which they are liable it is important that a fresh male from an unrelated strain be introduced at least every third season. During recent years several breeders have imported fresh blood of the Bronzewing breed from America, and have now the progeny available for disposal, so that there is no excuse for any one continuing to breed from birds that are too inbred. Whether it be the male or the female, it is a mistake to breed from birds until they are about two years old. Although it is common for first-year birds to be bred from, these seldom or never produce vigorous progeny.

In general it is a difficult matter to rear turkeys successfully when confined to a run, especially if the breeding-stock do not possess undoubted constitutional vigour and are not thoroughly domesticated. If the best results are to be obtained the birds should be allowed a free range, at any rate during the day, the whole year round. Of course, on small holdings and where there is a danger of their destroying a crop in the ripening stage, and particularly one belonging to a neighbour, then it may be found necessary to confine the birds in a

wire-netting enclosure. Where it is found really necessary to do this the larger the run provided the better will it be for the welfare of the birds.

In the mating of turkeys one male bird should be allowed to every eight to ten females. Turkey-eggs take about twentyeight days to hatch, and usually from seventeen to twenty eggs are sufficient for the hen to brood properly. Where breeding-turkeys are allowed to range it is a good plan to let the hen select her own nest and bring out her own chicks. When she has commenced to sit, care must be taken to disturb her as little as possible. It is a good plan to have food and water close by, so that she can come off the nest and obtain feed and water at will.

After the poults have been hatched for about twenty-four hours both the hen and her brood should be placed in a large open-fronted watertight coop made free from cracks in the sides and back walls as a preventive against draughts. In this way the birds are provided with plenty of fresh air without harm. Better far to have the birds in the open than in a coop through which the wind blows. Draught is as fatal to young poults as it is to chickens or ducklings. A suitable coop can be made on the lean-to style — say, 3 ft. square, 2 ft. 6 in. high in front, and 2 ft. at the back. The front of the coop should be covered with 1-in.-mesh wire netting, with a door consisting of a light frame covered with wire netting. The coop should have a wooden bottom raised slightly above ground-level. This will prevent the hen and her brood from getting swamped out if very wet weather conditions prevail.

For the first few days both the hen and poults should be confined to the coop, and during the next week the coop should be arranged in such a way that the young ones can have their liberty. This can be easily arranged by having a hinged board at the bottom of the door, which can be opened up or closed as required. By this means the poults are encouraged to take exercise, an essential for healthy growth. Many breeders, especially where the birds are being reared under semi-confined conditions, have a movable wire-netting run in conjunction with the coop. Thus the coop and run can be frequently removed to fresh ground, while in addition the young ones are protected from cats, weasels, &c., until they reach a safe age. Here may be emphasized the importance of clean ground; it is merely courting disaster to try and rear young turkeys on tainted soil. Unless the birds are being bred on an absolutely free range and in a natural way a brood coop such as described is invaluable. It is true that the mother hen can be depended upon to protect her young during the heaviest of rainstorms, but if they are later trailed through long wet grass the mortality is almost sure to be great.

Young turkeys require no food for at least twenty-four hours after being hatched. Then for the first few days they should be given stale bread soaked in milk and squeezed dry, in which some hard-boiled egg, finely minced, has been mixed. As a change they can have rice that has been boiled in milk. As the birds develop they may be given a mash made of finely-ground wheat, bran, maize-meal, and oatmeal. The food must be mixed to a dry consistency. When the poults are four weeks old they should be fed three times a day with mixed broken grains such as wheat, maize, or barley. Young poults are always

slow to take food, and it is a mistake to try and force them to eat. They have small crops, and require to be fed frequently, but only a little at a time. Young turkeys should be fed on flat wooden trays and not on the ground. On no account should mash food be left before them to become fermented, or bowel trouble is almost sure to follow. Clean water or milk should be given from the outset, and left before the birds at all times, while an ample supply of grit is essential for both old and young stock. Milk is a valuable drink as well as a food for young turkeys. Where this is provided special care must be taken to keep the containers in a thoroughly clean state. Finely-chopped green-stuff, such as lettuce, young onions, or dandelion-leaves, should be fed daily. Charcoal is also good for turkeys, and should be freely provided to birds of all ages.

One of the chief points in rearing young turkeys is to keep them free from vermin. To guard against these the sitting turkey should be well dusted with insect-powder before commencing to sit, and again before the pipping stage, while during the time she is rearing an occasional dusting will do good. The hen should not be dusted when the poults are very young, as the powder may get into their eyes and cause blindness. Where the hen is sitting in a dry place, and particularly when the weather is warm and dry, it is a good plan to keep the soil under the nesting-material slightly moist, especially at pipping-time. This will prevent the membrane lining of the shell from becoming so tough and dry that the young bird is unable to pierce it—a common cause of fully-developed chicks dying in the shell.

Where turkeys are being kept on a limited area of land and are allowed a free range at all times, or even during the day, they will pick up a great part of their living in green material, seeds, insects, &c. It is, however, a good plan to give them a light meal at regular times in the morning and evening, as this will encourage them to come home at night. Turkeys are great wanderers, and if not induced to come home at night to obtain food there is no telling where they may roam to if they have the opportunity. A suitable meal may consist of a mixture of grains such as wheat, maize, oats, &c.

In most parts of New Zealand turkeys do not require houses to sleep in; the less coddling they receive the better. There is no better place for a turkey to roost than on a rail fence or in a tree. In the management of turkeys any bird that appears sick should be isolated at once, particularly if the bird shows a serious decline in weight and the droppings are a green and yellow colour. These symptoms usually indicate that tuberculosis is present—a disease which turkeys are prone to. When a bird gives definite symptoms of being affected with this disease it should be destroyed and the carcase burnt.

When from eight to ten weeks old the young birds commence to get a red head. This period is one of the most critical of their lives, as from no apparent cause it is then common for them to suddenly die. At this stage the birds should be fed well away from the homestead, in order to induce them to take a maximum of exercise and secure an abundance of natural food. Plenty of chopped onions will be beneficial at this stage. The turkeys should also be encouraged to roost, preferably in trees. A person experienced in rearing turkeys recently informed the writer that he saved the lives of many birds by giving them a drop of port wine when the red head was beginning to show and they had taken a sudden seizure.

SEASONAL NOTES.

THE FARM.

MANIPULATION OF THE REAPER-AND-BINDER.

REAPING-MACHINES should now be overhauled and put in readiness for the approaching cereal harvest. The "binder" is admittedly one of the most complicated machines used on farms, and its manipulation calls for considerable skill, both in the correction of mechanical troubles and in the adjustment of the working-parts so that it continuously delivers straight-butted and well-tied sheaves.

The Reel.—The reel requires continuous adjustment, depending on the height of the crop and the direction in which the crop is leaning Its function is to bring the crop forward to the knife and over on to the platform. The reel should normally be set so that the vanes strike the crop just below the ears, and do not leave contact till the grain is falling towards the platform. If the grain is leaning away from the knife the reel must be moved forward and down; if leaning towards the knife, moved back.

The Platform and Canvasses.—Under ordinary conditions the platform is run sloped slightly forward to the knife, but its inclination must be altered, depending on the movement of the grain. If the grain tends to mount the elevators heads first, then lower the platform and tilt it backwards; if the grain moves butts first, raise it and run with a forward slope. The platform and elevator canvasses should be carefully attended to. All broken slats should be renewed, and it is usually best to replace any that are at all cracked, as these generally break later on and may hold up the machine. The canvasses must be buckled evenly, otherwise they tend to move to the tighter side, which strains the rollers and breaks the slats. Canvas shrinks when it is wetted, and the canvasses should be loosened each night either by an adjustment lever or by loosening the buckles. On putting the binder away at the end of the season the straps on the canvasses should be carefully oiled.

Binder-deck and Buttor-board. — The elevating-canvasses lift the grain from the platform canvass and deliver it at the top of the binding-deck. The grain is then moved down the packers by the buttor-board situated at the fore end of the binding-deck; an extension of this board straightens the butts of the sheaves. The board is adjustable for long and short grain, but should not be moved with the idea of altering the position in which the band is placed. The position of the band is altered by sliding the binding attachment backwards or forwards. The constant adjustment of the deck to suit varying heights in the crop is very important if the bands are to be properly placed on the sheaves.

Tying-mechanism.—The grain passes down the binding-deck over a length of twine until it reaches the compressor-arm, against which it is packed by three packers until a bundle large enough for a sheaf has been formed. The size of the sheaf is altered by moving the compressor-arm towards or away from the packers. Some machines

have a special trip-lever on the deck of the binder, and in altering the size of the sheaf this lever should be lowered for large sheaves and raised for smaller ones. When the sheaf is being formed the twine is held at one end in the twine-retainer in the knotter-head, and at the other end by the tension-rollers at or near the twine-can. If the tension-rollers hold the twine too tight the free end of the twine may be torn out of the twine-retainer, or the twine may break; if the rollers allow the twine to pass too freely the band is loosely laid round the sheaf. After the tension-rollers have been adjusted to make a straight band the tightness should be adjusted by altering the pressure necessary to set the binding-mechanism in motion. When a binder throws untied sheaves it is usually due to one or other of the following causes: (1) The needle may be bent and fail to pass the twine over the knotter-bills into one of the notches in the twine-retainer; (2) the twine-tension is too great; (3) the twine-retainer is loose and fails to hold the twine while the knot is being tied; (4) the spring of the knotter-bills is too loose; (5) the knife may be dull or out of time.

Driving-mechanism.—The sprocket-wheels and driving-chains should be carefully examined. The wheels should be exactly in line and the chains run fairly slack, as they are liable to break if too tight. All oil-holes should be carefully cleaned out, and to make sure that none is missed it is a good plan to do the entire length of one shaft before going on to the next. When operating a binder it is important to use good oil and lubricate the machine thoroughly. New machines generally require extra oiling.

HAYMAKING.

The best time to cut pastures for hay naturally depends on the weather and the type of pasture. When mowing permanent pastures it is generally desirable to cut early, aiming at a light cut of good-quality hay rather than a heavier cut later in the season. Early cutting conserves a closer turf on the pasture than late cutting, which leaves the cocksfoot-plants very tufted, the white clover stunted, and consequently a good deal of bare ground.

The green plants when cut for haymaking contain from 70 to 75 per cent. of water. Before they can be conserved as hay this water content must be reduced to 15 or 20 per cent. The wind and sun are relied on to dry the green material, and of the two the wind is the most satisfactory. There is a very general tendency to allow the hay to be entirely dried by the sun as it lies in the swathes left by the mower. A thin layer of mown grass exposed for long to the bleaching effect of the sun becomes very dry and brittle. If rain falls on the material left in the swathes or windrows to dry, a great deal of the soluble food material is washed out of the hay. Hay of high quality can usually only be obtained when it is cured in cocks, so that it loses its moisture by wind evaporation, retains its green colour, and is not so liable to be spoilt by rain falling during haymaking.

There is a general tendency at the present time to build very large haystacks, regardless of the state of dryness of the material put into the stack. When hay is stacked a slight fermentation takes place which gives rise to heat, and a certain amount of water is evaporated from the warm stack. With damp material this fermentation is more

marked, and a considerable amount of heat is generated. In the case of a stack having so great a diameter and height that the heat produced by fermentation cannot escape as quickly as it is liberated, the stack will go on rising in temperature till firing or smouldering occurs. Heat will escape more readily from a long narrow stack than from one which, although containing the same amount of material, is shorter and wider. Stacks placed in sheltered corners near plantations are more apt to heat than stacks well out in a paddock and exposed to the wind.

CROPPING OPERATIONS.

On Canterbury and North Otago mixed farms skim-ploughing of grassland for wheat can usually be commenced in December. Old short-rotation pastures usually throw little summer feed after November, and early skimming will not interfere to any extent with the carrying-capacity of the farm. Also, early skimming reduces the pressure of team work during the autumn months and allows the wheatland to get the benefit of a partial summer fallow.

Roots ridged in October and November will require thinning during the coming month. A proper horse-hoeing preparatory to thinning is very important. Cultivators having three tines should be used—an A-shaped tine to work the middle of the drill, and two L-shaped ones to cultivate near the rows. It is not advisable to use long curved tines near the plants at the early hoeing, as they frequently knock too much earth away from the sides of the drills and leave the roots of the seedlings exposed.

The later sowings of swedes, soft turnips, rape, and other green crops will be made towards the end of December, and care should be taken that the final cultivation of the land does not dry the seed-bed too much. Early ploughing, which allows the weather to help in breaking the clods, is usually much more satisfactory than late ploughing followed by heavy cultivation to force a tilth.

—P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.

THE ORCHARD.

SPRAYING OPERATIONS.

FROM the "fruit-set" period onward sprayings in the orchard will be more of a routine nature, much depending on the condition of the trees and the attacks of either fungous diseases or insect pests. Slightly longer periods between sprayings may be given, providing, of course, weather conditions are favourable. It will still be advisable to spray as soon as possible after rain, even if the previous spray has only just been finished.

Thoroughness should now be the main object. Trees are beginning to be fully covered with foliage, getting denser as the season advances. It will take longer to spray the orchard, and more material will be required. Leaving part of a tree or even a branch unsprayed may cause a serious attack of disease in the near future. At this time of the year it is often found that some varieties of apple-trees appear to be sickly, possibly on account of the heavy strain of seed-production.

With the exceedingly heavy blossoming that has taken place this season it will not be surprising if many trees, especially those growing on the poorer soils, are feeling the effects. Foliage appears to lag, and is of a yellowish colour, instead of a good dark green associated with a healthy tree. A little fertilizer, even at this late period, will be beneficial if thoroughly hoed in.

When spraying at this period it may also be advisable to use one of the precipitated sulphurs only, as these sprays act as a general reviver to the tree — more so than ordinary lime-sulphur. Lime-sulphur can be reduced in strength to 1–125; otherwise the spray advised in last month's notes can be used, with the addition of Black Leaf 40 should leaf-hopper put in an appearance. This pest is best controlled when in the nymph stage, and should therefore be sprayed on first sight. Red mite has been on the move for some weeks now, and it is only by thorough applications of lime-sulphur that this pest can be kept in check.

Periodical sprayings with lime-sulphur, 1–125, on stone-fruits for the control of brown-rot will be necessary, continuing up to two or three weeks before the fruit is ready for picking.

Black-spot on pears has been noticed for some time past, and another spraying with either bordeaux or lime-sulphur, according to variety, should be applied.

THINNING OF FRUIT.

Probably one of the most important operations in the orchard about this time is the thinning of fruit. As before indicated, blossoming has been very heavy this year, and a big crop of fruit of nearly all varieties is anticipated. To allow such a crop to mature would be disastrous not only to the future welfare of the tree, but as regards the size of the fruit this season. The common practice is to thin off all the black-spotted fruit; but this, on the present showing, will not be sufficient. The main object is to produce a good crop of uniform-sized fruit suitable for export, and this can only be accomplished by systematic thinning. Better results are always obtained, and there is more money in an average crop of high-grade fruit than in a heavy crop of undersized and inferior fruit.

During the past few years thinning has been done by many growers, but in the majority of cases too many apples have been left on the trees to mature. A common expression heard among growers at picking-time is "I thought I had thinned sufficiently." The fact is that growers do not like to see apparently good apples lying on the ground at thinning-time, but they appear to be quite content to pick them when mature and throw them on the ground rather than cart them to the packing-shed, owing to the unmarketable size. The extra expense, impaired vigour of the tree, lack of colour in other fruits on the tree, breaking of branches, and possibility of a very small crop in the following season, do not seem to be considered.

Thinning should be done as soon as the fruit is well set, thus giving the remainder a better chance to size and colour up properly. Go over the trees in a systematic manner, and where possible space the fruits to a uniform distance apart. Once systematic thinning is

done, the results will be so satisfactory that no grower will neglect the operation in future seasons.

MISCELLANEOUS.

The export of fruit will soon be round again. How many growers can say that everything is ready when that time comes? Every opportunity should be taken to make up cases, overhaul grading-machines, packers' benches, wrapping-paper, wood-wool, nails, &c. See that all stamps, pads, labels, ink, &c., are in readiness—in fact, get everything necessary so that no time will be wasted when the busy season starts.

Small fruits will now be maturing and ready to put on the market. It is advisable to have the "get up" as attractive as possible, and this can only be done by careful sorting and packing, placing each size and quality in its respective grade.

Continue the cultivation of the soil by the use of the disks and harrows, keeping the ground well stirred to a depth of 3 in. or 4 in. All soil-moisture will be needed during the next few months, and it can only be retained in the soil by good cultivation.

An application of nitrate of soda or sulphate of ammonia to any sickly or weak-growing tree will help to restore it to natural vigour.

The question of wiring trees should be considered at this time of the year. A good method is to insert a screw-eye on the inside of each of the branches at the proper height, and draw towards a ring in the centre by means of wire. With this method there is no fear of barking the limbs, or snapping of branches above the wire, as is often the case where wire is wound round the trees.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

The chief work for the coming month among citrus-trees will be continued tillage for the suppression of weeds and the proper aeration of the soil. Work the soil thoroughly and often to a depth of at least 5 in.; such workings not only permit better root-action, but conserve moisture and induce fibrous roots at a depth where they are not so detrimentally affected by dry weather as those nearer the surface. Strips of land between the trees and right under the branches should be cultivated to the same extent as land between the trees. Aim at clean cultivation and the maintenance of a friable surface-soil condition right through the grove.

As the petals fall from the lemon-flowers it will be necessary to spray with bordeaux, 4–4–40, in order to control verrucosis, which establishes on the fruits as soon as they form. As preventive sprays are the only control for this disease, repeated sprayings are necessary to ensure the covering of all fruits during the long flowering-period.

A summer insecticide of oil, 1–60, or Black Leaf 40, 1–800, is required to ensure a thorough control of insect pests, supplementing the autumn or spring sprayings. Black Leaf 40 may be added to the bordeaux for application.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

AMONG THE STOCK.

THE breeding season for fowls now being over, all male birds should be separated from the hens, which will lay as well, if not better, without the males. Any cocks that show signs of not being serviceable for future breeding should be disposed of at once; it is seldom that a male bird can be depended upon for breeding-purposes after the third year, and the keeping of such stock means a continued drain on the profits. The aim of the poultry-keeper should be to never have on the plant a bird which is not paying its way.

No attempt should be made to rear weaklings. Constitution is the base of disease-resistance and heavy-producing stock. It is therefore obvious that to waste time over a delicate chicken is not only inviting an outbreak of disease but is decidedly unprofitable.

There should be no delay in marking the feet of chickens for age-determination. It is the only means whereby the common mistake of disposing of a young profitable bird and retaining an old unprofitable one may be obviated with certainty.

CARE OF INCUBATORS.

A matter that now requires attention is the thorough cleaning and disinfecting of incubators. The lamps as well as the burners should be washed in boiling water, thoroughly dried, and then, together with the regulating-devices (connecting-rod, &c.), placed inside the incubator. This will not only assure that these parts are in good working-order when required next season, but the life of the incubator will also be greatly prolonged.

INCUBATING AND REARING OF DUCKS.

Where ducks are kept their eggs should now be set without delay for the renewal of the laying flock. Ducks are not nearly so difficult to hatch and rear by artificial means as is generally supposed—that is, provided common-sense methods of management are employed. The temperature during the period of incubation, at the level of the tops of the eggs on the tray, should be 102° F. for the first week; from this on to the pipping stage 103°; and 104° when hatching. If the right degree of temperature is maintained, and the eggs are fairly fresh when set, the ducklings will commence to pip late on the twenty-sixth day and hatch out on the twenty-eighth day. On no account open the incubator and attempt to help the young birds out of the shell unless they have been given their full time to hatch.

During the first week the eggs require very little cooling; after the third day they should be turned both morning and night; usually the time taken to do this is all the cooling they require for the first week. During the second and third weeks the time of cooling should be extended by degrees up to twenty minutes, while during the last week and up to the pipping stage they may be left out much longer. After the fifth day the eggs should be tested and the infertile ones taken out, whilst during the incubation process the eggs should be occasionally tested for the purpose of detecting and removing any with dead germs. Eggs containing the latter soon give off a bad odour, which is apt to injure

the hatching-qualities of the remaining eggs in the machine. Usually the shell of a decaying duck-egg becomes discoloured, and can be readily detected by a person of experience without the use of a tester.

One of the worst difficulties in artificially hatching duck-eggs is getting the air-cell to dry down to a desired line—a common cause of fully-developed ducklings dying in the shell at pipping-time. Trouble from this cause can be prevented by spraying water at a temperature of 103° (with the mouth) on the eggs after the fourteenth day. Do this immediately after turning, and place the eggs back in the machine. Do not cool after spraying; spray in the morning, and cool at night. The incubator-vents should at all times be partly open, so that any excess of moisture not required by the eggs can get away. Generally, no further added moisture is required. The spraying of the eggs not only has the effect of increasing the size of the air-cell, but also softens and weakens the membrane lining of the shell, which assists the young duckling to get out of its prison.

In rearing ducklings—no matter what class of brooder is being used—care must be taken to provide the young birds with an ample supply of fresh air. Without this the mortality is sure to be great. Of course, good ventilation should go hand-in-hand with a uniform degree of warmth—say, 90° at the start, and reduced by degrees as the ducklings develop.

During the first week the food of the young birds may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, and with 5 per cent. of fine grit (not sand) added. Feed four times a day a quantity that the birds will pick up clean in a few minutes. When the ducklings are about a week old the grit need not be mixed with the food, but it should be always available to them in a receptacle so that they can help themselves.

Finely cut green food should be fed separately after the first week; also at this stage some boiled mincemeat should be given, and increased by degrees as the ducklings develop. As they grow older, feed equal parts of maize-meal, pollard, and bran. It will generally be found best to moisten the mash with hot water until the birds are about two weeks old.

Water should be given with the first meal, and from then onwards it should always be left in reach of the birds, both by day and night. Probably the most common cause of mortality among ducklings is confining them by night in a brooder without water and giving them a heavy drink before receiving their morning meal. Ducklings affected from this cause usually stagger and give every indication of suffering from a fit. The drinking-vessels should be sufficiently deep, so that the birds can wash off any food that may adhere around their nostrils and at the same time give them a good blow-out. Once the nostrils are allowed to clog, the eyes become plastered and the duckling ceases to thrive.

Young ducklings should not be compelled to sleep on damp bedding, or loss of leg-power and other troubles are apt to set in. To prevent dampness the water-fountains should be placed in the run well away from the sleeping-quarters.

—F. C. Brown, Chief Poultry Instructor, Wellington.

HORTICULTURE.

THE TOBACCO CROP.

THE remarks of last month now apply to the later plantings, which should be in position in the field. After the close attention required while the plants were in the seed-beds, the present month comes as a rather welcome interval. However, careful consideration must be given to the preparations for the harvest. Curing-sheds will require cleaning up and refitting. For the benefit of those without experience, it will be well to state the curing practice here is to cut the mature plant down a little above the ground and split the butt to within 2 in. or 3 in. of the end; it is then threaded on to a curing-stick. These sticks are an inch or two over 4 ft. long and 1 in. in diameter. They usually carry from eight to ten plants, and are hung in the shed by resting the ends of the sticks on tier poles. These are strong squared timber, 2 in. by 4 in., lying horizontally, and held in position by bolting them to uprights; they are usually 4 ft. apart both ways. As the loading is done by a man standing on a plank in this scaffolding, it is important that it should be sufficiently strong; serious accidents have occurred through neglecting this point

If the distance between curing-sticks on the tier-poles is reckoned at 8 in., it is now possible to work out the accommodation required for curing the crop. This is generally short of requirements, and makeshift devices have to be resorted to. Whatever arrangements have to be made, if they are worked out now it will give best results, as there will be no time for planning during the busy harvest period.

FRUIT SECTION.

The harvesting of raspberries and currants black, white, and red commences this month. To keep the two first-named in bearing they must not be allowed to become at all dry. If such conditions are inclined to prevail the plantations should be irrigated. There are many crops of the kind growing on land which is inclined to be drained too quickly in summer that would give a greatly increased yield under irrigation. The strawberry crop also in such cases would benefit from a similar attention.

Summer-prune white and red currants, also gooseberries, as required. Train in the best of the loganberry new wood so that it does not interfere with the bearing-canes, cutting out weak growth.

TOMATO-GROWING.

Tomatoes under glass will now be in full bearing and yielding the most valuable part of their crop. To maintain production careful attention must be given them, especially in the matter of ventilation. The dense bulk of vegetation in the average house at the present time quickly becomes mildewed if the atmosphere is close. The normal plant of this kind prefers a dry buoyant atmosphere, and to maintain this the ventilation must be extended in early morning before the temperature rises. If the plants are normal there is not much danger now of chilling them, except by a decided cold draught. Such attention is an important factor in the prevention of mildew, which so seriously interferes with the functions of foliage as to prevent the fruit from

swelling, and in the worst cases seriously diminishes the crop. The trouble is very serious in the warmer districts. Some houses have been built without giving the ventilators much thought, and they are of small capacity for even a cold climate. Under such conditions the plants come away particularly well until about the end of October, when they have attained about two-thirds of their mature height; then under the conditions of a close atmosphere and high temperature mildew breaks out seriously.

Plans of glasshouses in other countries may be of great interest to us, and the extensive ranges built about the larger centres of population in cold countries have many interesting new features in construction and heating, but in adopting a design we must see that it is adapted to our local conditions and the crop we wish to grow. A glasshouse 14 ft. wide, without ventilation, in a colder country may grow very good cucumbers, but to build in the warmer districts here a similar house, but of twice the width, and to expect to grow tomatoes in it is sure to bring a very disappointing experience. There is probably no glasshouse crop in which the foliage is so dense and the proportion of air-space so small as the average tomato crop under glass in summer. Any one who knows anything of the importance of light and air in the economy of plant function will realize the difficult task before the grower in his desire to successfully ripen the large crops without delay. Where this trouble is serious the grower should carefully study the position, and so learn all that is possible from the unpleasant experience, and make plans for the necessary alteration.

Feeding the plants at short intervals with liquid fertilizers will improve the quality and quantity of the crop. The standard packing of tomatoes for a whole district is a very fine ideal worth considerable sacrifice to obtain, but meantime a grower will be wise to standardize his own pack and see that each box contains an even grade of a distinct class. The wholesale buyer's first business is to learn the brands being marketed and allot to each a reputation. The most payable reputation is probably that for a clean, consistent pack that is true to label.

The outside crop will need suckering and tying. Meanwhile keep a sharp lookout for disease, and spray as necessary. In some instances it will pay to carefully remove infected plants or leaves and burn them.

MARKET-GARDENS.

When lifting the early potato crop it will often pay well to carefully select the seed tubers from the best stools; in this way true seed of high strain is obtained. Tubers of the size of a hen's egg are most desirable, but larger ones may be cut when planted. Too often good land and careful attention are given to mixed seed of inferior quality. In some districts late blight is prevalent in the main crop, and it is necessary to spray with bordeaux. This treatment should now be commenced, as the danger period is at hand; 4–4–40 is the usual formula, but this may be increased to 5–5–40 or 6–6–40 for the following applications, which are made at intervals of two to three weeks.

Important work now is the consideration of the winter crops of celery, leeks, savoy, broccoli, and cauliflowers. The plants in the seed-beds will soon be ready for setting out. Water the beds well

the day before lifting the plants, which should afterwards be lifted with care and stood in tin trays for removal to the field. This should be done towards the end of the month. Meanwhile the preparation of the land should be completed as soon as possible. In moist land with plenty of humus extensive plantings of celery could well be made. The modern commercial method is to set the plants 6 in. apart in shallow furrows 3 ft. to 4 ft. apart, and later blanch the stems by moulding them up. In the warmer districts cauliflower might well take the place of broccoli, which, although hardier, takes a long time to mature.

On land inclined to be dry it is well to remember that the lettuce, cucumber, and marrow crops require ample supplies of water at this season. If this requirement is supplied occasionally, together with suitable fertilizers, the results will be satisfactory. Pinch back the leading shoots of the gourds in order to produce lateral growth and thrifty plants.

A halt should now be called to the pulling of rhubarb and cutting of asparagus. Feed up the beds well, and see that they do not lack necessary moisture. By building up the plants now the following spring crop will be enhanced.

MANURE ECONOMY.

The relationship of stock to the successful cultivation of the soil is important, and demands more consideration if the highest economy in crop-production is to be realized. The supply of organic manures has decreased, but that is all the more reason why the most should be made of what is available. Before application to the land this class of manure should be well decayed. When fresh or dry it is comparatively useless, and the danger of introducing a crop of bad weeds is great. To produce the required decayed condition it must be placed in a compact heap and kept moist, so that the necessary fermentation will be induced. This is best done on a sloping concrete floor in a sheltered position, when, if a convenient sump is built, the drainings may be used with advantage as a liquid manure on many crops. Manure from the poultry-pens may be stored in concrete bins and covered occasionally with earth. Sometimes it is allowed to dry out, and it is then put through a mill and ground fine, and used in much the same way as a chemical fertilizer.

Successful plant-production consists very largely in a skilful use of manures, but an important factor is obtaining a cheap supply of good quality. Conservation and treatment of all available supplies should now be made in readiness for the heavy demands in early winter. Growers situated near the sea-coast where quantities of seaweed are available should remember that this material is about equal to farm-manure as a soil-dressing. Soot and wood-ashes, if kept dry, are also valuable.

Another waste material that might be put to more economical use is the trimmings and trash that form an unsightly heap in most gardens and plantations. Stacked on rough logs to keep it off the ground and from decaying, it would serve a useful purpose if during the winter it were spread over a piece of land to be used later for seed-beds and burnt. In this way it would sterilize the

soil, and add to the latter useful quantities of charcoal and potash that would very much benefit subsequent crops.

—W. C. Hyde, Horticulturist, Wellington.

THE APIARY.

BROOD-REARING AND QUEEN-EXCLUDERS.

WITH the advent of December all danger of the bees dying of starvation should be over. If the bees have received the required attention, work should have progressed in the first super, and some of the stronger colonies may require even more room. Where excluders are not being used the queen, if young and vigorous, will probably be making use of at least three of the centre combs in the super. This is no cause for regret; it is rather a good sign, provided the combs in the brood-chamber are fully occupied with brood. A good young queen requires more laying-room than is provided in a ten-frame brood-chamber. If it is desired to use excluders to ensure that all combs in the super are free from brood at extracting-time, that objective can be attained by inserting the excluders a month before it is proposed to extract. By that time the swarming season will be practically over, and, as the queen will not be laying quite so freely, less room will be required for brood.

SWARMING-CONTROL.

The putting-on of the first super will have checked the first impulse to swarm, but difficulties in this connection are not over, and further measures will be necessary. Various schemes have been introduced from time to time to control swarming, and some of them have received considerable support even from commercial beekeepers. The method adopted must be largely determined by local conditions. The bees require considerably less attention in districts favoured with a light or medium honey-flow extending from November to March. In some parts of the Dominion the flow is confined to a few weeks from mid-December to the middle of February at the longest, and the flow during that time is very erratic. Sometimes the nectar is coming in so fast that the bees appear to become frantic in their endeavours to find room for it. Every available cell is filled, with the result that the queen is restricted in her laying and the swarming impulse engendered. If every colony is headed by a young queen, swarm-control is then simply a matter of providing plenty of room for the use of the queen, and the storage of honey, and ventilation.

The method adopted successfully by some beekeepers, and known as the Demaree system, consists in lifting the brood, with the exception of two frames containing open brood and the queen, over an excluder. This plan is open to objection owing to the fact that too large a proportion of the bees go into the super and remain on the brood. The combs in the brood-chamber are not cleared up, nor is the foundation drawn out for the use of the queen, with the result that her laying is restricted. This difficulty can be overcome very largely by placing a super of empty combs immediately over the brood-chamber, and the brood as a second story on top. Queen-cells will be started on the brood, and if these are not required they should be destroyed.

Many commercial beekeepers control swarming adequately by simply drawing the bees up into further supers. When the first super

is about three-parts full, lift it off and put the new super, containing drawn combs or frames fitted with full sheets of foundation and one frame of brood taken from the brood-chamber or from the centre of the first super, in its place. Then place the first super on top. When this new super is about three-parts full, put on still another immediately over the brood-chamber, fitted as recommended in the case of the first two supers.

ARTIFICIAL INCREASE.

This is accomplished by simply dividing established colonies and furnishing each queenless portion with a ripe queen-cell or, preferably, a laying queen. If a maximum of increase is desired, irrespective of a crop of honey, each colony can be divided to form a number of nucleus colonies each containing two frames of brood and one empty comb. Each division, with the exception of the portion remaining on the site of the old hive, should be shut up for three days, otherwise practically the whole of the field-bees will forsake the newly formed nuclei and return to the site of the old colony. Do not unduly confine a young laying queen to a limited number of frames, but give the additional combs when required. A queen-bee ages prematurely if prevented from functioning naturally.

FOUL-BROOD.

Every colony affected with this serious disease should be treated immediately the honey-flow commences. Approved treatment consists in shaking all the bees on to frames containing a narrow strip of foundation, and four days later brushing them from the pieces of comb they have built on to frames fitted with full sheets of foundation. If there are a number of colonies to be treated the brood can be placed over an excluder put on one of the weaker colonies, and, when all the brood has hatched out, treated in the usual way. The combs, if not too badly infected, may be melted into wax, and the frames sterilized by immersion for a few minutes in boiling water and used again. The utmost care, however, must be exercised to keep all infected material out of the way of the bees. Section 3 of the Apiaries Act provides that "every beekeeper in whose apiary any disease appears shall, within seven days after first becoming aware of its presence, send written notice thereof to any Inspector appointed under this Act."

BIG HONEY-YIELDS.

At the annual conference of beekeepers held at Christchurch last June the writer referred to the excellent honey season that had been experienced in Canterbury and the good crops taken in the district. A case was instanced in which a beekeeper had taken 22,400 lb. from 190 colonies of bees. While such crops are above normal, they tend to show that Canterbury can, in common with other districts, produce large crops of honey when the weather conditions are normal. Now comes a report from South Canterbury of a crop taken from sixty colonies, where the total yield amounted to 19,040 lb. of white honey, or an average of 317 lb. per colony. In addition the bees were placed in winter quarters with an average of 45 lb. of sealed honey for each hive. This return may rank as a high-level record for New Zealand, and is here chronicled in order that such a mighty effort on the part of the little honey-bee should be well recorded.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JULY TO OCTOBER, 1927.

Dairy Division.

THE time of year has now been reached when the majority of our certificates of record are issued. The appended list contains particulars of 178 records, the greater proportion of the certificates represented having been gained during the past month. Apart from its numerical strength, the list is of more than usual interest on account of the number of outstanding performances recorded, including three which constitute new class-leaderships and one 1,000-lb.-butterfat yield. Monavale Queen Bess, the 1,000-lb.-butterfat cow, was commented upon fully in last month's *Journal*, and some notes regarding the new class-leaders are now given.

IVONDALE OXFORD LASS.

The leadership of the junior two-year-old Jerseys now goes to Ivondale Oxford Lass, with 731·29 lb. of butterfat, replacing Mr. G. E. Yelchich's Keston Flower by a margin of 37·01 lb. butterfat. Ivondale Oxford Lass was bred by Mr. P. J. Petersen, of Brixton, Waitara, but was sold to Mr. R. S. Tuck, of Waharoa, under whose ownership her C.O.R. test was conducted. She is by the imported sire Xenia's Oxford Lad, and her dam is Ivondale Rainbow's Lass, who has gained two certificates of record. Ivondale Rainbow's Lass is a daughter of Ivondale's Rainbow—sire of seven C.O.R. daughters—and is a half-sister of Ivondale Golden Rainbow, leader of the senior two-year-old Jerseys. The new leader commenced her test at the age of 1 year 338 days. Considering her age, the performance is an especially fine one, and will be difficult to displace. Her milk-yield was 12,107·7 lb., and she was milked three times daily during practically the whole of her test period.

MATANGI MATILDA 4TH.

The second new class-leader appears in the junior four-year-old Milking Shorthorns, Matangi Matilda 4th, with 630·38 lb. butterfat, having increased the record by some 22 lb. over that of Matangi Nancy 2nd. As her name conveys, Matangi Matilda 4th was bred by Messrs. Ranstead Bros., of Matangi, but during the testing-period just concluded she was owned by Hon. Mrs. E. J. Blyth, Kohimarama, Auckland. She is from Matangi Matilda 2nd by Dominion Glaxo of Ruakura. Her maternal grandsire is the well-known Dominion Esau of Ruakura, sire of fourteen C.O.R. daughters, several of which are class-leaders. He will also be remembered as sire of Matangi Quality 4th, one of the most outstanding Milking Shorthorn cows in New Zealand.

Passing reference may also be made here to Braeside Sweet Nell 2nd, also appearing in the Milking Shorthorn list, whose record of 851·21 lb. butterfat is only a few pounds below that of Glenthorpe Lady, the mature class-leader of the breed. Braeside Sweet Nell 2nd was bred by Mr. W. H. Carter, Auckland. During her testing-period she was herd-mate of Matangi Matilda 4th and owned by Mrs. Blyth.

WAYWARD 6TH B NO. 1.

The Red Poll cow Wayward 6th B No. 1 goes to the head of the four-year-old class, increasing the previous record by no less than 131·57 lb. butterfat. She succeeds Susie Ann (448·48 lb. butterfat) tested by Mr. B. W. Harvey, Waverley. Wayward 6th B No. 1 is also leader of the two-year-old Red Polls, her two-year-old record being 511·42 lb. Her performances both as a two-year-old and as a four-year-old are the highest for the breed in New Zealand. She was bred by Sir R. Heaton Rhodes, Tai Tapu, but was owned by Mr. G. S. Young, West Plains, Invercargill.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Ivondale Oxford Lass*	R. S. Tuck, Waharoa ..	1 338	240·5	365	12,107·7	731·29
Te Aute Annie ..	W. T. Williams, Pukehou ..	1 324	240·5	365	10,076·9	662·81
Marairohia Fancy* ..	G. E. Yelchich, Waiuku ..	1 314	240·5	365	9,996·1	651·42
Meadowvale Nonette	R. S. Tuck, Waharoa ..	2 12	241·7	365	9,450·2	603·42
Princess Mermaid* ..	G. E. Yelchich, Waiuku ..	1 363	240·5	365	11,239·1	581·07
Ngahiwi Romantic ..	W. J. Freeth, Pukearuhe ..	2 2	240·7	365	9,681·5	552·73
Pinewood's Viola ..	G. H. Bell, Oakura ..	1 329	240·5	336	8,689·6	525·94
Kahuwera Bo-peep ..	Johnson Bros., Te Awamutu	2 40	244·5	365	8,212·5	512·58
Rydal Robin ..	T. M. Remington, Westmere	1 336	240·5	365	9,917·2	510·19
Jersey Bank Bonny ..	J. J. Goodwin, Morrinsville	1 360	240·5	333	9,215·2	500·56
Jerseydene Fairy ..	T. Wells, Dargaville ..	2 42	244·7	365	8,071·8	498·10
Queen Betty ..	Mrs. E. E. Burgess, New Plymouth	2 3	240·8	365	9,171·5	494·06
Ngahiwi Exile's Secret	W. J. Freeth, Pukearuhe ..	1 330	240·5	365	8,791·3	487·47
Velebit Silver Maid ..	G. E. Yelchich, Waiuku ..	1 303	240·5	305	8,462·3	486·01
Linden Grove Lovely	Mrs. M. A. Gadsby, Stratford	1 300	240·5	365	7,481·0	476·31
Poneke Hope ..	C. S. Leggett, Motumaoho..	1 349	240·5	365	7,955·9	462·54
Glenavon Joffre ..	J. Townsend, Puni ..	1 278	240·5	365	8,890·8	449·94
Brentwood Queen ..	C. A. Willis, Pukekohe ..	1 306	240·5	365	7,728·5	446·09
Brentwood Peggie ..	C. A. Willis, Pukekohe ..	1 349	240·5	305	8,318·0	430·28
Invergourie Sweet Bye Bye	J. C. Davidson, Dannevirke	1 334	240·5	305	8,350·8	430·11
Floral Lark ..	Mrs. A. M. Irwin, Puni ..	1 316	240·5	348	7,197·0	419·64
Holly Oak Silhouette	F. Jennings, Mauriceville ..	1 273	240·5	344	8,430·5	418·25
Rydal Tui	T. M. Remington, Westmere	1 351	240·5	293	7,187·9	413·27
Ivondale Heather Brae	G. R. and H. Hutchinson, Auckland	2 10	242·1	362	6,246·4	412·41
Bonnie Primrose ..	J. J. Goodwin, Morrinsville	1 269	240·5	349	5,694·8	403·28
Marshlands Stylish Betty	W. J. Chynoweth, Pukeroro	1 361	240·5	305	5,840·8	403·15
Koro Koro Topsy ..	Mrs. Southee and Sons, Kiwitahi	1 355	240·5	365	6,650·0	403·06
Fern's Oxford Aldan	G. R. and H. Hutchinson, Auckland	1 337	240·5	357	6,005·5	401·22
Glenwillow Lassie ..	A. J. K. Campbell, Matakana	1 326	240·5	365	7,953·2	400·27
Alfalfa Perfection ..	Cook Hospital Board, Gisborne	1 326	240·5	310	6,259·9	399·91
Kuranui Margaret ..	O. Glynn, Morrinsville ..	1 331	240·5	365	6,057·5	397·99
Oxford Dale Plume ..	J. T. Entwisle, Cambridge..	1 347	240·5	297	5,530·2	389·22
Koro Koro Sea Queen	Mrs. Southee and Sons, Kiwitahi	1 363	240·5	364	7,119·0	371·97

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Ivondale Gold Chain	C. J. Masters, Hunterville	1 352	240·5	342	8,189·0	369·15
Belswardyne Nell ..	Mrs. Southee and Sons, Kiwitahi	1 280	240·5	365	5,978·5	366·68
Marshlands Cream ..	W. J. Chynoweth, Pukeroro	1 337	240·5	365	6,580·1	364·62
Coniston Bilberry ..	R. Waterhouse, Papakura	1 205	240·5	351	5,908·5	362·84
Burrwood Beatrice ..	J. B. Tonar and Son, Northcote	1 327	240·5	365	6,862·6	346·48
Celia of Aria ..	M. V. Reeve-Smith, Aria ..	1 322	240·5	262	5,525·8	345·21
Holmvale Heather ..	J. W. Topham, Temuka ..	1 339	240·5	364	6,303·9	335·54
Meadowvale Limelight	T. W. Perger, Waitara ..	1 359	240·5	326	5,156·4	334·51
Brookley Princess ..	W. Johnson, Ngaere ..	1 349	240·5	312	5,329·0	333·37
Holly Oak Sylvia ..	T. H. Western, Bell Block	1 320	240·5	322	6,294·4	331·08
Marshlands Jewel ..	W. J. Chynoweth, Pukeroro	1 246	240·5	365	5,263·9	319·95
Bettina	D. Marra, Dargaville ..	1 210	240·5	355	5,743·2	319·74
Marshlands Elina ..	W. J. Chynoweth, Pukeroro	1 325	240·5	365	4,197·8	318·75
Te Aute Tiny ..	W. T. Williams, Pukehou	1 327	240·5	252	5,865·9	315·69
Pukepapa Molly June	H. Cole, Tikorangi ..	2 16	242·1	300	4,226·3	310·24
Tyntesfield Iris ..	R. K. Garland, Okauia ..	1 292	240·5	313	5,492·5	297·86
Marshlands Star Lady	Mrs. M. A. Wright, Piarere	1 225	240·5	294	4,698·8	287·41
Armon Neateyes ..	E. Beech, Matapu ..	2 23	242·8	276	5,241·5	270·61
Longview Fortune ..	Brakenridge Bros., Taupaki	2 18	242·3	268	5,084·0	269·26
Kelvin Sunshine ..	G. Buchanan, Paeroa ..	1 252	240·5	321	4,452·6	250·47
Senior Two-year-old.						
Rosina Buckman ..	A. S. W. Hazard, Waimate North	2 332	273·7	365	11,187·6	675·82
St. Lambert's Superior	Boon Bros., Poroporo ..	2 314	271·9	363	9,135·8	593·79
Glen Willow Girlie ..	A. J. K. Campbell, Matakana	2 324	272·9	365	9,514·3	548·79
Cloudland's Tyrrel ..	R. Harper, Otorohanga ..	2 330	273·5	365	9,395·5	522·43
Bo-peep's Lassie ..	R. A. Lewis, Dargaville ..	2 361	276·6	341	8,165·9	515·51
Linden Grove Lucinda	A. S. W. Hazard, Waimate North	2 363	276·8	365	10,385·3	514·19
Mermaid's Perfection	A. E. Sly, Whakaronga ..	2 318	272·3	365	9,395·6	503·83
Bandy	F. Phillips, Otorohanga ..	2 290	269·5	365	8,769·0	496·70
Aldan's Royal Neathead	O. J. Lancaster, Palmerston North	2 331	273·6	365	7,014·4	480·02
Lisbury Royal Maid	Mrs. M. A. Jennings, Mauriceville	2 232	263·7	365	7,800·0	473·78
Seacliff Magnet ..	A. S. W. Hazard, Waimate North	2 313	271·8	353	8,145·9	453·97
Glenbriar Frisky ..	G. Taylor, Ngarua ..	2 282	268·7	365	7,329·5	432·77
Oakland's Lilabelle ..	T. H. Western, Bell Block ..	2 272	267·7	338	6,220·4	431·17
Vernon Golden Petune	G. R. and H. Hutchinson, Auckland	2 59	246·4	335	6,733·6	426·56
Rozel's Una Sweet ..	J. J. Goodwin, Morrinsville	2 321	272·6	327	6,176·6	401·59
Brown Bess ..	C. A. Willis, Pukekohe ..	2 328	273·3	365	6,349·7	394·45
Te Aute Sybil ..	W. T. Williams, Pukehou ..	2 363	276·8	339	6,334·1	381·58
Koro Koro Clematis	Mrs. Southee and Sons, Kiwitahi	2 314	271·9	365	6,748·0	360·12
Dalethorpe Fairy ..	A. R. Clark, Hamilton ..	2 346	275·1	298	5,901·4	357·33
Jersey Meadows Grace	W. H. Ridge, South Norsewood	2 341	274·6	323	6,433·4	346·81
Honeyfield Fancy ..	W. H. Ridge, South Norsewood	2 322	272·7	318	6,273·4	346·71
Kowhai Dewdrop ..	W. R. Jamieson, Bull's ..	2 331	273·6	347	5,510·2	334·67
Corra Lynn Tinopai	A. Best, Bombay ..	2 277	268·2	203	4,725·3	272·64

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Ashley's Bud ..	W. T. Dazeley, Pukekohe ..	3 54	282·4	365	12,899·4	682·75
Auroa Primrose ..	J. C. Duff, Auroa ..	3 221	299·1	365	9,871·8	652·65
Oak Farm Wonder Girl	G. B. Knowles, Tariki ..	3 330	310·0	364	10,184·7	626·68
Reid Park Light of Day	C. A. Willis, Pukekohe ..	3 343	311·3	365	10,265·5	596·71
Glenavon Princess ..	J. Townsend, Puni ..	3 256	302·6	365	10,101·7	593·75
Brentwood Lady Madge	C. A. Willis, Pukekohe ..	3 338	310·8	365	10,231·6	589·07
Golden Senorita ..	A. G. Buchanan, Palmerston N.	3 263	303·3	365	8,899·9	573·34
Pinewood's Golden Girl	G. H. Bell, Oakura ..	3 278	304 8	365	9,689·5	560·16
Hilltop Best ..	A. S. W. Hazard, Auckland	3 27	279·7	365	9,335·1	547·53
Brooklyn Moon Moth	H. J. Lancaster, Glen Oroua	3 314	308·4	365	9,642·1	524·70
Fern Grove Lady Elfie	T. W. Perger, Waitara ..	3 343	311·3	350	8,568·0	524·68
Rosedale Sweet Marie	E. J. Adams, Puni ..	3 32	280·2	358	8,364·9	491·01
Jersey Meadows Duchess	H. H. Phillips, Te Rehunga	3 296	306·6	365	8,834·1	469·50
Teasler	M. G. McArthur, Auckland	3 355	312·5	365	9,735·0	447·34
Vernon Cherry Bloom	G. R. and H. Hutchinson, Auckland	3 318	308·8	298	8,086·2	428·28
Tamaki Flo ..	A. E. Peppercorn, Cambridge	3 196	296·6	293	6,337·7	421·34
Okauia Lady's Maid..	R. K. Garland, Okauia ..	3 301	307·1	364	8,027·5	402·13
Lass's Buttercup ..	R. Harper, Otorohanga ..	3 332	310·2	352	7,023·1	398·51
Merrie Meade Encore	W. T. S. Wilson, Otahuhu..	3 319	308·9	332	7,530·0	394·05
Armon Monica ..	E. Beech, Matapu ..	3 31	280·1	319	7,742·9	389·31
Marshlands Golden Fern	Mrs. M. A. Wright, Piarere	3 294	306·4	365	7,120·0	360·76
Rosy Creek Marjorie	E. Beech, Matapu ..	3 350	312·0	316	7,185·4	354·18
Four-year-old.						
Oak Farm Princess Mary	G. B. Knowles, Tariki ..	4 334	346·8	365	11,098·8	684·43
Staccato Blue Bird ..	H. Hyland, Hastings ..	4 290	342·5	365	10,711·4	650·08
Miss Doreen ..	R. Haylock, Ngaere ..	4 32	316·7	365	10,926·7	604·61
Brentwood Dainty ..	C. A. Willis, Pukekohe ..	4 290	342·5	365	10,083·5	596·79
Pukaki Rose ..	W. Robinson, Patumahoe	4 240	337·5	362	10,425·5	573·52
Poplarvale Vesta ..	R. C. Henry, Bell Block ..	4 285	342·0	365	9,158·6	564·65
Silver Pet's Daphne	F. P. King, Hautapu ..	4 3	313·8	365	8,856·2	525·05
Poplarvale Heather ..	R. C. Henry, Bell Block ..	4 347	348·2	365	8,458·4	510·57
Tot	J. Mitchell, Hopelands ..	4 137	327·2	309	9,449·4	509·28
Brentwood Favourite	C. A. Willis, Pukekohe ..	4 317	345·2	365	7,638·0	502·74
Madam Fox of Heathcote	H. W. Le Bailly, Buckland	4 327	346·2	365	10,354·2	485·78
Abberley Sybil ..	T. Ranford, Whakaronga ..	4 360	349·5	365	9,332·2	467·86
St. Aubin's Galanthus	J. Torbet, Waiau Pa ..	4 211	334·6	332	8,810·8	458·29
Springvale Bright Eyes	E. Beech, Matapu ..	4 15	315·0	329	8,581·2	442·06
Matai Nui Diadem ..	C. J. Startup, Eltham ..	4 290	342·5	336	6,726·5	413·61
Bonne Lass ..	J. Torbet, Waiau Pa ..	4 340	347·5	352	7,733·4	401·09
Koro Koro Empress	Mrs. Southee and Sons, Kiwitahi	4 7	314·2	365	6,783·8	385·00
Mature.						
Oaklands Golden Tulip	F. W. Cornwall, Bell Block	5 216	350·0	365	12,037·4	717·87
Berenice	R. Haylock, Ngaere ..	7 354	350·0	365	11,412·1	700·61
Jersey Brae Royalty	W. Robinson, Patumahoe ..	5 360	350·0	365	10,306·3	693·70
Oak Farm Mademoiselle	G. B. Knowles, Tariki ..	5 281	350·0	364	10,965·4	687·62
Oak Farm Sylvie ..	G. B. Knowles, Tariki ..	5 356	350·0	365	12,017·8	685·93
Brooklyn Golden Lassie	H. J. Lancaster, Glen Oroua	5 4	350·0	365	10,536·7	644·37

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Viola's Fair Lady ..	R. Harper, Otorohanga ..	5 295	350·0	365	9,092·5	632·02
Silver Flower's Ruby	R. Harper, Otorohanga ..	6 112	350·0	365	9,384·0	626·82
Jersey Brae's Dainty	W. T. S. Wilson, Otahuhu..	7 320	350·0	365	9,242·3	607·70
Jewel's Winsome ..	W. Devine, Palmerston N.	6 300	350·0	362	11,669·5	595·61
Fair View Daisy ..	W. T. Williams, Pukehou ..	6 361	350·0	364	9,706·3	552·60
Lady Magdala ..	C. J. C. Powell, Opuawhanga	5 354	350·0	365	10,297·0	550·50
Falconite's Joy ..	Mrs. A. M. Irwin, Puni ..	7 65	350·0	365	11,983·3	531·54
Abberly Maid ..	T. Ranford, Whakaronga ..	6 335	350·0	365	10,158·4	521·72
Jollification ..	Mrs. R. Henry, Omata ..	5 263	350·0	354	8,164·6	513·17
Silver Flight ..	N. Moore, Tapanui ..	6 47	350·0	301	9,870·9	510·53
Poplarvale Bluebell ..	R. C. Henry, Bell Block ..	5 322	350·0	351	7,517·3	491·62
Silkworm	J. Malone, Riverlea ..	6 364	350·0	327	8,786·3	478·22
Lady Totara ..	W. Devine, Palmerston N.	9 25	350·0	325	7,549·9	472·61
Cloverlea Mahoe ..	J. Malone, Riverlea ..	5 246	350·0	363	9,128·5	470·67
Portia	C. J. C. Powell, Opuawhanga	10 227	350·0	365	6,841·2	449·55
Joyance	Mrs. R. Henry, Omata ..	8 174	350·0	357	8,392·5	448·85
Spec's Marigold ..	J. Torbet, Waiau Pa ..	5 14	350·0	308	8,263·9	441·29
Silver Queen's Beauty	A. E. Sly, Whakaronga ..	6 97	350·0	349	9,721·7	421·13
Cowslip's Gipsy ..	M. V. Reeve-Smith, Aria ..	5 287	350·0	270	9,072·9	402·84
Maori Beauty's Doreen	W. T. Williams, Pukehou ..	5 258	350·0	217	8,712·5	401·35
Campania	C. J. C. Powell, Opuawhanga	11 267	350·0	365	6,747·7	399·97
Sylvia, K. G. ..	R. K. Garland, Okauia ..	6 341	350·0	315	7,891·6	388·91
Koro Koro Duchess	Mrs. Southee and Sons, Kiwitahi	7 24	350·0	365	7,895·3	366·12
Roslyn Twin Girl ..	J. Torbet, Waiau Pa ..	8 352	350·0	302	5,976·2	358·38
Keithdale Carnation..	M. G. McArthur, Auckland	5 260	350·0	293	6,520·1	351·64
	FRIESIANS.					
Junior Two-year-old.						
Rosevale Echo Sylvia Colantha*	North and Sons, Omimi ..	2 144	254·9	365	20,309·2	732·56
Rosevale Queen Isobel Posch*	T. Sheriff, Clandeboye ..	2 140	255·0	365	21,792·2	701·30
Bywell Queen Alcartra*	T. H. Richards, Cardiff ..	1 339	240·5	365	14,279·2	587·98
Rosevale de Kol Plus Sylvia*	North and Sons, Omimi ..	2 170	257·5	365	18,680·6	538·16
Livingstone Lady Wakaloma	W. J. Eames, Hunterville ..	2 129	253·4	365	13,944·0	535·43
Dominion Pride of Domino	Central Development Farm, Weraroa	2 43	244·8	365	12,840·9	458·33
Dominion Ina Woodcrest	Central Development Farm, Weraroa	2 133	253·8	365	12,373·5	398·40
Glenmore Netherland Rose	D. H. Johnson, Stratford ..	1 314	240·5	364	7,718·7	337·86
Fendalton Nellie Posch 2nd*	J. I. Royds, Christchurch ..	2 7	241·2	257	8,889·7	245·53
Senior Two-year-old.						
Rosevale Sylvia May Echo*	North and Sons, Omimi ..	2 224	262·9	365	17,862·8	583·93
Pareora Cadilac Snow*	A. S. Elworthy, Timaru ..	2 340	274·5	365	14,181·0	522·14
Dominion Spot Beets	Central Development Farm, Weraroa	2 259	266·4	365	13,913·9	469·08
Willowburn Queen Mentor*	C. H. Potter, Pukerau ..	2 218	262·3	253	10,136·0	403·59
Bainfield Princess Pietertje*	McDonald and Co., Dunedin	2 242	264·7	365	10,903·9	398·23
Dominion Mary Fobes	Central Development Farm, Weraroa	2 356	276·1	365	10,388·2	338·09

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	FRIESIANS—*continued.*	Yrs. dys.	lb.		lb.	lb.
Junior Three-year-old.						
Bainfield Sylvia Delhurst 5th*	W. Robertson, Middlemarch	3 11	278·1	353	16,025·5	682·95
Senior Three-year-old.						
Woodlands Pontiac May 6th*	Smart and Son, Tikorangi	3 210	298·0	172	8,087·6	318·50
Senior Four-year-old.						
Highland Princess* ..	C. J. Schumacher, Ngaere	4 348	348·3	339	13,670·1	538·99
Mature.						
Monavale Queen Bess*	T. H. Richards, Cardiff ..	7 363	350·0	365	26,461·8	1002·20
Rose of Ngaere* ..	C. J. Schumacher, Ngaere ..	6 214	350·0	365	20,504·4	794·26
Cluny Pietje Lulu* ..	Piri Land Co., Auckland ..	6 13	350·0	365	17,479·3	656·77
	MILKING SHORTHORNS.					
Senior Three-year-old.						
Pine Farm Jewel 4th A	Estate of John Fisher, Pukerimu	3 296	306·6	365	10,555·8	452·82
Junior Four-year-old.						
Matangi Matilda 4th*	Hon. Mrs. E. J. Blyth, Kohimarama	4 0	313·5	358	14,640·2	630·38
Mature.						
Braeside Sweet Nell 2nd*	Hon. Mrs. E. J. Blyth, Kohimarama	6 293	350·0	365	16,981·6	851·21
Pukekite Duchess* ..	Hon. Mrs. E. J. Blyth, Kohimarama	5 294	350·0	332	11,194·5	485·57
Braeside Lucy* ..	Hon. Mrs. E. J. Blyth, Kohimarama	8 258	350·0	348	11,546·9	481·61
	AYRSHIRES.					
Two-year-old.						
Braeside Barbara† ..	W. F. Olson, Egmont Village	2 33	243·8	365	12,855·0	552·79
Three-year-old.						
Maesgwyn Ivy ..	C. M. Williams, Kaiapoi ..	3 266	303·6	365	12,426·4	519·64
Four-year-old.						
Maesgwyn Mignonette	C. M. Williams, Kaiapoi ..	4 77	321·2	318	11,645·5	456·60
Edendale Jewel ..	W. Hall, Lepperton ..	4 245	338·0	338	9,684·3	394·91
Mature.						
Maesgwyn Miro ..	C. M. Williams, Kaiapoi ..	6 4	350·0	365	14,233·4	563·63
Keitha of Edendale ..	W. Hall, Lepperton ..	7 35	350·0	296	9,457·6	353·11
	RED POLLS.					
Two-year-old.						
Neutyle Sunbeam* ..	G. S. Young, West Plains ..	2 79	248·4	365	10,479·0	345·24
Dominion Cigar ..	Central Development Farm, Weraroa	2 27	243·2	365	6,332·9	337·66
Dominion Zeeland ..	Central Development Farm, Weraroa	2 319	272·4	339	6,967·1	317·01
Four-year-old.						
Wayward 6th B No. 1*	G. S. Young, West Plains ..	4 297	343·2	365	13,290·0	580·05
Mature.						
Dominion Ruapehu	Central Development Farm, Weraroa	6 353	350·0	365	10,527·4	427·17

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Second-class Certificates.						
Jerseys.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Vernon Golden Rose	G. R. and H. Hutchinson, Auckland	1 298	240·5	365	6,643·7	399·69
Friesians.						
Junior Two-year-old.						
Rosevale Sylvia Burkeyje*	North and Sons, Omimi ..	2 146	255·1	365	12,833·7	475·19
Rosevale Doreen Sylvia*	North and Sons, Omimi ..	2 20	242·5	365	15,030·1	463·43

IMPORTATION OF FERTILIZERS.

FOLLOWING are the importations of fertilizers into New Zealand for the six months ended 30th September, 1027 :—*Sulphate of Ammonia :* From United Kingdom, 521 tons ; Australia, 525 tons ; Germany, 3 tons. *Nitrate of Soda :* Chile, 620 tons. *Basic Slag :* United Kingdom, 5,069 tons ; Belgium, 11,337 tons ; France, 22 tons. *Bonedust :* India, 700 tons ; Australia, 25 tons. *Chardust and Bone Char :* Australia, 101 tons. *Guano :* United Kingdom, 25 tons. *Phosphates :* New Caledonia, 1,902 tons; Seychelles Island, 3,678 tons; Walpole Island, 1,143 tons; Ocean Island, 22,620 tons ; Nauru Island, 47,388 tons ; Makatea Island, 7,599 tons ; Australia, 4 tons ; Egypt, 6,603 tons. *Superphosphate :* United Kingdom, 100 tons ; France, 120 tons. *Kainit :* United Kingdom, 20 tons ; Belgium, 50 tons ; France, 167 tons ; Germany, 142 tons. *Muriate of Potash :* France, 15 tons ; Germany, 3 tons. *Sulphate of Potash :* United Kingdom, 10 tons ; France, 297 tons ; Germany, 371 tons. *Potash, other :* France, 925 tons ; Germany, 663 tons. *Sulphate of Iron :* United Kingdom, 5 tons ; Australia, 17 tons ; United States of America, 7 tons. *Other Fertilizers :* United Kingdom, 1 ton ; Germany, 7 tons ; United States of America, 13 tons.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 22nd September to 3rd November, 1927, include the following of agricultural interest :—

No. 56515 : Device for cleaning dairy utensils ; W. A. Tomlinson, Waitangi, Waikato. No. 56849 : Manure-mixing machine ; Automatic Mixers, Ltd., Dunedin. No. 57093 : Fruit-sacking machine ; O. A. Moe, Yakinia, U.S.A. No. 57854 : Stock-food ; U.S. Farm Feed Corporation, New York. No. 58290 : Manure-distributor ; J. L. Cowern and N. W. Storey, Rangiatea. No. 57177 : Hedge-cutting machine ; R. A. Reston, Auckland. No. 57502 : Twitch-working implement ; F. T. McAnulty, Chertsey. No. 58251 : Milk-releaser ; G. J. Heaven, Masterton. No. 59092 : Fence-post ; V. G. Symes, Culverden. No. 57252 : Grubber ; A. E. Hosking, Johnsonville. No. 57568 : Cream-improvement process ; M. O'Callaghan, Buenos Aires. No. 57749 : Device for securing lids to fruit-cases ; M. Davey, Blenheim. No. 57826 : Threshing-mill ; C. Collett and J. H. Collett, Invercargill. No. 59142 : Sheep-shearing machine ; J. Davidson, Sydney, N.S.W.

Copy of full specifiations and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

WEATHER RECORDS: OCTOBER, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows:—

During October rainfall was, as a rule, poorly distributed in time and place, and the 14th and 23rd were the only days on which it was at all of a general character. The total for the month was considerably below normal over the whole of the North Island and in the Marlborough and Nelson Provinces in the South Island. Canterbury and Otago had a moderate excess, while in Westland the differences from normal were slight.

Pressure was chiefly of the westerly type, and the disturbances of slight to moderate intensity. The changes were generally too rapid to allow of rain developing to any extent. On the 23rd, however, a very intense cyclone developed east of the South Island, and on the 24th the Chatham Island barometer fell to 29·07 in. From the 23rd to 25th strong southerly winds to gales were experienced, and very cold temperatures prevailed in the rear of this cyclone. Light falls of snow occurred on the 23rd and 24th in various parts of the South Island, and also in the high central area of the North Island. Ground frosts were reported on the mornings of the 25th and 26th, more especially in Canterbury and Otago, but the damage to fruit-trees was fortunately only slight.

There was a tendency for anticyclones to move in more northern latitudes, but one, which controlled the weather between the 25th and the 29th, was centred over New Zealand on the 27th with pressure as high as 30·50 in.

On the whole, fair to fine weather predominated, with moderate to strong north-westerly winds. The cold spell from 23rd to 25th, however, was severe, especially in Canterbury and Otago, and some losses of lambs occurred. Though dry, the month was a good spring month. It was particularly favourable for sheep, but less so, owing to the dryness, for the dairy industry.

RAINFALL FOR OCTOBER, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	1·84	6	0·68	4·48
Russell	3·58	7	2·01	4·06
Whangarei	3·62	7	1·35	4·64
Auckland	2·66	12	0·78	3·64
Hamilton	1·80	11	0·62	4·79
Kawhia	2·36	10	0·74	5·28
New Plymouth	2·96	11	0·53	5·48
Riversdale, Inglewood	5·60	11	1·52	10·37
Eltham	2·42	10	1·10	4·11
Whangamomona	3·83	10	1·04	9·11
Tairua	2·48	7	0·84	6·89
Tauranga	2·07	8	0·55	5·25
Maraehako Station, Opotiki ..	3·38	9	1·20	5·45
Gisborne	1·07	6	0·46	2·80
Taupo	1·49	5	0·44	4·28
Napier	0·47	5	0·40	2·30
Maraekakaho Station, Hastings ..	0·74	9	0·30	3·09
Taihape	2·49	7	0·71	3·99
Masterton	2·59	8	0·82	3·32
Patea	3·15	9	1·35	4·11
Wanganui	1·20	1	1·20	3·67
Foxton	2·28	8	..	2·92
Wellington	1·92	8	0·67	4·19

RAINFALL FOR OCTOBER, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	5·83	21	1·17	6·97
Greymouth	9·04	22	1·52	10·03
Hokitika	12·64	23	2·21	11·84
Ross	14·01	18	3·65	15·16
Arthur's Pass	25·77	20	6·29	19·78
Okuru, Westland	14·46	19	1·94	15·37
Collingwood	3·02	5	1·72	11·03
Nelson	1·07	7	0·47	3·59
Spring Creek, Blenheim ..	0·68	5	0·40	2·72
Tophouse	3·45	13	0·98	5·90
Hanmer Springs	3·36	10	0·95	3·15
Highfield, Waiau	2·00	7	0·58	2·60
Gore Bay	2·68	6	1·10	2·25
Christchurch	2·75	9	1·03	1·68
Timaru	2·34	11	0·76	1·95
Lambrook Station, Fairlie ..	2·40	7	0·58	2·01
Benmore Station, Clearburn ..	1·82	9	0·92	2·09
Oamaru	2·36	12	0·62	1·68
Queenstown	2·79	13	1·12	3·48
Clyde	1·33	7	0·46	1·58
Dunedin	5·01	19	1·06	3·09
Wendon	3·32	13	0·74	2·50
Gore	3·92	20	0·78	3·37
Invercargill	4·09	24	0·56	4·44
Puysegur Point	12·05	23	1·62	8·16

TRIALS WITH WHITE ISLAND MINERAL DEPOSIT.

In the September issue of the *Journal* a negative result was reported from the use of White Island mineral deposit on grassland at Waihou. It may be stated that the material used in this trial was not the standardized No. 1 Product now sold by White Island Products, Limited, the guaranteed sulphur content of which is 33 per cent. In the trials at present being carried out by the Department of Agriculture only the standardized products of the company are being used.—*T. H. Patterson, H.D.A., Instructor in Agriculture, Auckland.*

FOOT-AND-MOUTH DISEASE IN GREAT BRITAIN.

The High Commissioner for New Zealand, London, has reported by cable the position of foot-and-mouth disease in Great Britain as follows: September—two outbreaks in Bedford and four in Glamorgan; October—eight outbreaks in Somerset, one in Wilts, and one in Middlesex: total, sixteen outbreaks for the two months.

Importation of Swine from Canada.—Regulations under the Stock Act governing the importation of swine from Canada were published in the *Gazette* of 10th November. A statement regarding this matter appeared on page 204 of the September *Journal*.

Books received.—The "New Zealand Flock Book," Vol 23, 1927; published by the Council of the New Zealand Sheep Breeders' Association, Christchurch. The "Pig Breeders' Annual, 1927–28"; published by the National Pig Breeders' Association, London.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STOCK AND COPPER-SULPHATED WATER.

"INQUIRER," Havelock North :—

In the September number of the *Journal* in an article on "Braxy-like Disease of Sheep" there is mentioned among other preventive measures the use of copper sulphate. Would you kindly inform me if there is any danger of stock being poisoned by drinking from small springs and pools which have been treated in this manner?

The Live-stock Division :—

It is not likely that sheep, unless very thirsty, would touch water medicated recently with copper sulphate. When a stream or pool is dosed with copper sulphate the material dissolves readily, and would not remain long in a poisonous strength in the water. However, as there is a slight risk to the sheep, it is advisable to give the paddock a spell for about three days following the treatment. No mortality has been reported so far from farms where copper-sulphate dressing has been carried on extensively for some time past.

HEDGES FOR RECLAIMED MUD-FLATS.

"MUD-FLAT," Opotiki :—

Could you tell me of any suitable hedge-plant to grow on reclaimed mud-flats, both as a stock-proof hedge and to be useful as a breakwind? Barberry does not appear to thrive on the wet clay at all.

The Horticulture Division :—

Reclaimed mud-flats of wet clay are rather extreme conditions for which to suggest suitable stock-proof shelter-belts. In the absence of barberry, which you say does not thrive there, there is little choice other than the Lombardy poplar or some species of willow. Planted close together, either of these would probably do well. They would be to a great extent stock-proof, and, when planted close, would not grow to a great height. On this class of land it is a very good system to make the large open drains, which are necessary at intervals, coincide with the boundaries of paddocks, and to plant the shelter-belt along the bank formed of the excavated soil from the drain, with a wire fence to protect it from stock, the drain itself protecting it on the other side. Under such conditions barberry, pines, or even probably Lawson's cypress would do very well.

CONTROL OF WEEDS IN LUCERNE.

"LUCERNE," Enfield :—

In March, 1926, I drilled 20 acres with lucerne and got a splendid strike, but owing to the wet autumn the weeds also came well. Would it injure the lucerne-plants to cultivate the land (with fine tines) in November after feeding off or mowing; or would it be better to wait until next winter to do the work? The stand was not cultivated last winter.

The Fields Division :—

If the weeds referred to are fat-hen or yarr there will be little occasion for anxiety concerning the lucerne, as both these types will rapidly disappear after cutting or grazing. Lucerne-plants have extremely stout tap roots, and even when quite young stand fairly heavy cultivation. If by Christmas-time the lucerne does not appear to be overcoming the weeds, then we would advise a thorough cultivation. Summer cultivation after mowing is much more effective in ridding lucerne from grass and other weeds than winter cultivation. If grass is already growing in the lucerne, cultivation after the first cutting is advised

MILK-TESTING POINTS.

"OLD SUBSCRIBER," Whakarongo :—

Kindly oblige me with information on the following: (1) Can a Babcock testing-machine (six- or twelve-bottle size) be adapted to use Gerber glassware? (2) Can amyl alcohol be used to improve Babcock testing; if so, in what manner, and how much?

The Dairy Division :—

(1) A mechanic could probably alter a Babcock testing-machine so that Gerber butyrometers or test-bottles could be used in it. We would recommend that butyrometers of the "original" Gerber method be used. These bottles are about 7⅛ in. long over all. (2) The use of amyl alcohol is not necessary or advisable in connection with the Babcock method of testing milk or cream for content of fat.

STERILIZATION OF HONEYCOMBS.

L. D. CARTER, Napier :—

Would you kindly tell me if the method of sterilizing empty honeycombs with a solution of formalin and water (1 to 20) for forty-eight hours is approved and recommended by the Department of Agriculture in connection with the control of foul-brood?

The Horticulture Division :—

The sterilization of honeycombs with formalin solution is not generally recommended. If you have only a small number of combs on hand it will pay you better to destroy them. However, should you desire to try the formalin solution the following treatment may be given: Water (soft preferably) 4 quarts, liquid soap 2 oz., formalin 1 quart; immerse the combs for forty-eight hours, then thoroughly dry and air them for several days.

FEEDING OF HAY AND ENSILAGE.

E. W. MCCARTER, Te Awamutu :—

I shall be glad to know whether ensilage can be fed to ewes in lamb without damage. Can you give the relative values of hay and ensilage for this purpose? Can you advise also as to whether ragwort if cut with hay retains its injurious properties when fed out with the hay?

The Live-stock Division :—

Ensilage can be fed to ewes in lamb without danger, provided it is not acid or mouldy. The relative value of hay to silage is 1 lb. hay equals ⅝ lb. silage, according to quality. Ragwort cut with hay retains its injurious properties.

SEMESAN FOR SEED-TREATMENT.

E. G. GANDY, Waipatiki :—

Page 12 of the *Journal* for July, 1927, describes a seed-treatment for dry-rot of swedes and turnips with a solution of Semesan. Can you tell me where I can procure this specific, and the approximate price?

The Fields Division :—

So far as we know, Semesan is not yet on sale in New Zealand. The manufacturers are the Du Pont de Nemours Co., Wilmington, Delaware, U.S.A., and the cost is about 2·75 dollars per pound. In Australia Semesan can be procured from R. F. Higgs and Co., 297 Castlereagh Street, Sydney, N.S.W., who are agents.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 87·28 per cent. With 7,905,432 breeding-ewes in the North Island, as shown in the 1927 sheep returns, the number of lambs is estimated at 6,899,861. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

THE following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 8th November, the figures being based on a card census: Wheat—North Island, 4,400 acres; South Island, 265,600 acres: total, 270,000 acres. Oats—North Island, 27,000 acres; South Island, 285,000 acres: total, 312,000 acres. Barley—North Island, 3,000 acres; South Island, 18,500 acres: total, 21,500 acres. The corresponding final totals for the preceding season (1926–27) were 221,689 acres of wheat, 386,762 acres of oats, and 30,414 acres of barley. Wheat, therefore, has an estimated increase in area this season of 48,311 acres, oats a decrease of 74,762 acres, and barley a decrease of 8,914 acres. The areas under the different main varieties of wheat grown this season are specified as follows: Tuscan or Longberry, 182,158 acres; Hunter's, 34,163 acres; Velvet or Pearl, 11,319 acres.

Also from a card census and at date 8th November the Statistician estimates this season's area under potatoes as 5,100 acres in the North Island and 17,100 in the South Island, or a total of 22,200 acres. The corresponding final figures for the 1926–27 season were 5,942, 18,674, and 24,616 acres. Only holdings of 1 acre and over outside borough boundaries are covered by these figures; a fair aggregate area of potatoes is also grown on smaller holdings and within boroughs. Reckoned on the average of the last five seasons—5·34 tons per acre—the total yield from this season's area would be 118,500 tons, as compared with a total actual yield of 116,771 tons for 1926–27, in which the per-acre yield was below the average.

QUALITY OF BASIC SLAG.

IN his annual report for 1926-27 Mr. B. C. Aston, Chemist to the Department of Agriculture, remarks as follows on this subject:—

The quality of the basic slag imported into New Zealand has received attention during the year. It was not found that any low-grade slag was being offered, but in certain instances slag that was distributed direct to the consumer from the ship's side was found to be below the manufacturers' guaranteed analysis, and a suggestion by this Section that imported basic slag should be examined before shipment to New Zealand has been adopted. Arrangements have now been made whereby slag exported to New Zealand from British and Continental ports will be sampled and analysed in England by the chemists of the Imperial Institute. It will thus be possible to warn importers of any shipments that do not comply with the manufacturers' guarantee, and so allow of adjustments being made before the fertilizer is placed on the New Zealand market. The scheme, which is now in operation, has received the unanimous approval of importers, whose co-operation is necessary to ensure that all shipments are sampled.

Cider-making. It is estimated that some 60,000 gallons of cider, valued at approximately £3,750, were produced in New Zealand during 1926–27—an increase of 10,000 gallons as compared with the previous year's figures. Up-to-date cider mills and presses are now being made in the Dominion.

Correction.—A misprint occurred in the bottom line of page 270 of last month's *Journal* in connection with egg-incubation temperatures. The temperature printed as 130° should have been 103°.

The New Zealand

Journal of Agriculture.

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AGRICULTURAL LEGISLATION OF 1927.

F. S. POPE, Acting Director-General of Agriculture, Wellington.

A CONSIDERABLE number of Acts of Parliament affecting the pastoral, agricultural, and horticultural industries, and coming within the scope of the Department of Agriculture, were added to the law of New Zealand during the recent session. While there may not be complete unanimity as to the value of certain of the provisions of these new laws, the fact that they have been approved, either unanimously or by substantial majorities, by both Chambers of the Legislature, may be taken as conclusive evidence that they are likely to be of material benefit to the industries affected by them.

Any one who has been concerned in preparing even a single Bill and piloting it through Parliament will not need to be told that the task of placing the past session's agricultural legislation upon the statute-book has involved a large amount of initiative, careful thought, patient discussion, and sound judgment on the part of the responsible Minister and his officers. Every one, therefore, who is either directly or indirectly interested in the industries mentioned (and who in New Zealand is not ?) owes a debt of gratitude to the Hon. O. J. Hawken, Minister of Agriculture, for having supervised the preparation of this large amount of valuable legislation and brought it safely past the rocks and shoals of keen parliamentary criticism to the desired haven.

The names of the Acts referred to are as follows: Massey Agricultural College Act, 1927; Canterbury College and Canterbury Agricultural College Amendment Act, 1927; Howard Estate Amendment Act, 1927; Institute of Horticulture Act, 1927; Fertilizers Act, 1927; Noxious Weeds Amendment Act, 1927; Seeds-importation Act, 1927; Orchard-tax Act, 1927; Fungicides and Insecticides Act, 1927; Introduction of Plants Act, 1927; Finance Act, 1927 (No. 2), (section 38); Stock Amendment Act, 1927; Slaughtering and Inspection Amendment Act, 1927; and Apiaries Act, 1927.

Of these, the first four deal with agricultural education; the next three mainly affect field-cropping and pastures; the next four relate principally to horticulture; and the last three concern live-stock, public abattoirs, and bees respectively. Let us look at them seriatim.

on the understanding that only the main points will be noticed, and that any one desiring the full particulars should consult the complete Acts, any of which can be obtained at slight cost from the Government Printer.

MASSEY AGRICULTURAL COLLEGE ACT, 1927.

The institution that is in future to be known as the Massey Agricultural College was given legal sanction by the New Zealand Agricultural College Act, 1926, which may therefore be referred to as the principal Act in this connection. The purpose of the Act of 1927 was to amend and amplify the principal Act. The main changes are as follows: The principal Act may in future be cited as the Massey Agricultural College Act, 1926, and the College itself is to be known as the Massey Agricultural College, instead of by its original name. For University purposes attendance at the Massey Agricultural College is deemed to be equivalent to attendance at Auckland University College or Victoria University College. This will enable degrees in agricultural science to be obtained through the Massey Agricultural College. The Council of the new College is given power to issue diplomas in agricultural science. Authority is given for the expenditure on the latter College of moneys under the Education Purposes Loans Act, 1919, not only for the purposes of that Act, but also for the purchase of live-stock, implements, or material. In general the Minister of Agriculture, instead of the Minister of Education, is made the connecting-link between the Government and the College.

CANTERBURY COLLEGE AND CANTERBURY AGRICULTURAL COLLEGE AMENDMENT ACT, 1927.

The existing legal sanction for the Canterbury Agricultural College (generally known as Lincoln College) is found in the Canterbury College and Canterbury Agricultural College Act, 1896, and in the amendments thereto. Last session's Act makes the following further amendments: For University purposes attendance at the Canterbury Agricultural College is deemed to be equivalent to attendance at Canterbury University College. This will enable degrees in agricultural science to be obtained through the Canterbury Agricultural College. The Council of the Agricultural College is given power to issue diplomas in agricultural science. The Council is increased by three members—from seven to ten—of whom two (instead of one) are to represent the Government, and two the Board of Governors of Canterbury University College. Provision is made for a Government subsidy on voluntary contributions to the funds of the Agricultural College. Authority is given for a Government grant not exceeding £10,000 to be applied, in accordance with the approval of the Minister of Agriculture, towards the erection, alteration, and equipment of the College buildings. Authority is also given for an annual grant, if voted by Parliament, of £3,700 for such research as is approved by the Minister of Agriculture after consulting the Council of Scientific and Industrial Research. In general the Minister of Agriculture, instead of the Minister of Education, is made the connecting-link between the Government and the College.

HOWARD ESTATE AMENDMENT ACT, 1927.

It will be remembered that the late Josiah Howard bequeathed his Smedley Station in Hawke's Bay to His Majesty the King without any restriction, but in confidence that the Government of New Zealand would use the property as a foundation or endowment for the purposes of agricultural education. To give effect to the testator's wishes the Howard Estate Act, 1919, was passed. It provided that the Public Trustee should hold the estate in trust as a permanent endowment for the purposes of agricultural education, the revenue to be used for (*a*) the establishment and maintenance of a school or institute of agricultural education, under the control of the Minister of Agriculture, and to be known as the Howard Agricultural Institute; and (*b*) the improvement and development of the estate. Minor amendments in this principal Act were made by the Howard Estate Amendment Act, 1926. Further amendments as follows were made by the Act of last session: (1) A Board—to be known as the Howard Estate Advisory Board—is constituted of representatives of the local authorities of the Hawke's Bay Provincial District to advise the Minister of Agriculture and the Public Trustee in regard to the management of the estate and the utilization of the revenue therefrom; and (2) it is provided that, in addition to the purposes mentioned under (*a*) and (*b*) above, the revenue from the estate may be used for the assistance and development of agricultural research or public agricultural education in New Zealand in a manner likely to be of special, but not necessarily exclusive, benefit to farming in the Provincial District of Hawke's Bay. This latter provision will enable such research and education to be carried on, if thought desirable, elsewhere than at the Howard Agricultural Institute when the latter is established. As soon as the necessary regulations as to its election can be prepared and gazetted, the Advisory Board will begin to function, and doubtless the utilization of the fund for the purposes for which it was created will commence without unnecessary delay thereafter.

INSTITUTE OF HORTICULTURE ACT, 1927.

The Institute is an incorporated body of persons interested in the advancement of horticulture in New Zealand, and includes horticulturists, scientists, public men, and private citizens in all parts of the Dominion. A number of other bodies whose objects bear upon horticulture are affiliated to the Institute. The latter is desirous of issuing authoritative certificates and diplomas to qualified horticulturists, with the dual object of (1) encouraging gardeners and others earning their living by doing horticultural work to undertake further study in order to obtain the Institute's certificate or diploma, and (2) giving persons proposing to employ gardeners or other horticultural workers a means of knowing whether applicants are properly qualified. The Act of last session authorizes the Institute to conduct examinations under a scheme to be approved by the Government, and to grant certificates and diplomas upon the results of such examinations. There is also provision for the issue, during a limited period, of diplomas without examination to horticulturists of not less than forty years of age and not less than twenty years' experience, and also provision for issuing

certificates or diplomas to persons arriving from abroad with proof that they have already passed equivalent examinations. The Institute is now preparing its scheme of examinations for submission to the Government for approval, and as soon as this is given the way will be clear for the Institute to make known to intending students the syllabus and conditions of the examinations to be passed before its certificate or diploma can be obtained. This should result within a comparatively few years in placing the horticulture of New Zealand upon a distinctly higher level.

FERTILIZERS ACT, 1927.

This Act, which comes into force on 1st June next, gives more complete control over the sale of artificial manures than that provided by the Fertilizers Act, 1908, which it repeals. The main changes in the law as it stood under the old Act are as follows:—

(*a*) Vendors must disclose the percentage and nature of any "filler" or "diluent" included in a fertilizer. Filler or diluent is defined as any substance not containing in appreciable amount nitrogen, phosphoric acid, or potash, which is incorporated mechanically and not by any chemical process as a component of any fertilizer.

(*b*) Vendors must also disclose the form in which the fertilizing ingredients contained in the fertilizer occur; for instance, in the case of phosphoric acid insoluble in water the vendor must state whether the phosphoric acid is included as basic slag, phosphate rock, bonedust, or as the case may be.

(*c*) A vendor may at his option disclose the percentage of phosphoric acid insoluble in water but soluble in a solution of citric acid of prescribed strength.

(*d*) Whenever so prescribed by regulations the fineness of grinding of the fertilizer or of any of its components must be stated.

(*e*) The registration of brands with the Department of Agriculture in the case of vendors who are not manufacturers or importers is considerably simplified, the vendor having merely to state the name and brand of the fertilizer and by whom it is registered.

(*f*) Provision is made for the sale of fertilizers in bulk—*i.e.*, unbagged—subject to suitable restrictions.

(*g*) The existing provision that all fertilizers must be put into branded bags as soon as manufactured is done away with.

(*h*) The provision that a fertilizer containing any imported ingredient must be contained in bags branded "Imported" has been dropped.

(*i*) The use of chemical contractions instead of words in full in the invoice certificates supplied to purchasers is prohibited.

(*j*) The period during which a purchaser may notify an Inspector that an official sample of any fertilizer is required to be taken has been extended to twenty days after delivery.

(*k*) Provision is made for prescribing by regulation definite limits of error that may be permitted in stating percentages of fertilizing ingredients.

(*l*) The form of invoice certificate to be issued to buyers is made more complete, and should ensure that a buyer with a fair knowledge of the subject will be able to obtain a clear idea of what he is buying.

(*m*) The sale—under the designation of "fertilizer"—of any material in respect of which a brand could not be registered under the Act is prohibited.

(*n*) Where fertilizer is imported or purchased for distribution by any organization—*e.g.*, a dairy company—to its members, without a sale taking place, the distributor must give to the Department and to each recipient of the fertilizer the same particulars as would have been shown in the invoice certificate had the transaction been a sale.

The regulations needed to give full effect to the Act are now being prepared, and will be gazetted as soon as practicable. [Further information regarding this Act will be found in a special article published elsewhere in this issue.—ED.]

NOXIOUS WEEDS AMENDMENT ACT, 1927.

The law in regard to noxious weeds is contained in the Noxious Weeds Act, 1908, and in the amendments thereto made in 1910, 1921, and 1923. The Act of last session makes the following changes in that law: (*a*) It relieves occupiers of land of their liability to prosecution without notice for failing to clear weeds; (*b*) it enables notice to clear such weeds as are growing in small patches to be given by general notification in the newspapers at suitable times without awaiting the flowering of the weeds; (*c*) it enables individual notices to clear weeds that are growing otherwise than in small patches to be given at suitable times without awaiting the flowering of the weeds; (*d*) it gives authority for an occupier who fails to clear weeds to be prosecuted twice, instead of only once, in each season, and fixes the minimum fine in the case of such second prosecution at £5; (*e*) it places the onus of clearing weeds, after individual notice or public notification has been given, not only upon the person in occupation of the land, but also upon the owner or any other person in receipt of the rents and profits of the land, and upon the agent or trustee of the occupier; and (*f*) it relieves the Department of Agriculture of the control of weeds in urban areas, and gives the urban authorities power to exercise such control if they so desire.

It is expected that these changes will enable the Department of Agriculture to gradually obtain better control of the weeds nuisance without inflicting undue hardship upon landholders.

SEEDS-IMPORTATION ACT, 1927.

Two objects are aimed at by this Act: first, to prevent certain kinds of imported seeds being sold as locally grown seeds, and, second, to prevent imported seeds of the same kinds being subsequently exported as New Zealand seeds. The kinds of seeds named in the Act are those of cocksfoot, lucerne, and white clover, but power is given to the Governor-General in Council to add other kinds to this list if it is found desirable to do so at any future time. The Act provides that before any seeds included in the list are imported into the Dominion in parcels exceeding 28 lb. in weight they shall have been so treated as to render them distinguishable from seeds not so treated, and authority is given for the making of regulations prescribing the treatment to be adopted for this purpose.

These regulations will be made as soon as practicable, and well before the Act takes effect on 1st April next. They will probably provide that 1 per cent. of the seeds shall be stained red. This treatment is both cheap and effective, and it does not prevent the germination of even those seeds that are actually stained, and has no effect whatever upon the 99 per cent. of unstained seeds. It may be thought that the staining of only one seed in a hundred would not be very noticeable, but in fact the red seeds stand out clearly, and make it quite impracticable to substitute, whether by accident or design, treated lines for untreated without detection being quite easy, or even to mix treated lines with untreated without discovery being almost certain.

It is hoped that the operation of this Act will result in an increased demand for our own seeds in the local market, and in the further development of the overseas trade in New-Zealand-grown seeds.

(To be concluded.)

GOVERNMENT CERTIFICATION OF SEED POTATOES.

PROGRESS OF THE SYSTEM IN CANTERBURY.

J. W. Hadfield, H.D.A., Instructor in Agriculture, Christchurch.

There has been a very satisfactory response by Canterbury farmers in connection with seed-potato certification under the system described in the *Journal* for August last. Eighty-one growers have registered, many of them sending in more than one variety, and altogether 138 eligible lines have been received and planted at the Ashburton Experimental Farm.

Growers were requested to send in 100 sets of each line, and great care has been taken to plant these under the most uniform conditions. Grouping of the varieties under these conditions will afford very interesting comparisons, more especially in regard to vitality, and it will be possible to obtain a general survey and some idea of the standards to adopt before actual field inspection commences. These plots are open to inspection by any one interested, and it is hoped to arrange for a field-day early in January, when growers, merchants, and seedsmen will be invited to attend.

In addition to the certification trials, over 100 varieties of potatoes are being grown at Ashburton Experimental Farm. These have been collected from all parts of New Zealand, and are being used primarily with the object of preparing accurate descriptions of all standard varieties, also to clear up some of the confusion existing in regard to nomenclature. A start is also being made in the production of pure and healthy lines of our commercial varieties, and about 250 are growing on trial.

The accompanying table gives a general idea of (1) the distribution of registered growers in Canterbury, (2) the distribution of registered varieties in Canterbury, and (3) the number of lines of each variety received.

Distribution of Registered Potato Varieties and Growers in Canterbury, Season 1927-28.

Variety.	Waitaki to Pareora.	Pareora to Rangitata.	Rangitata to Rakaia.	Rakaia to Waimakariri.	North of Waimakariri.	Lines of each Variety.
Dakota	0	3	11	14	0	28
Arran Chief	4	5	2	10	2	23
Aucklander Short-top ..	0	0	0	4	12	16
Epicure	1	2	1	7	3	14
Up-to-date	1	0	1	8	1	11
Bresee's Prolific ..	0	0	1	8	0	9
Aucklander Tall-top ..	0	1	1	0	6	8
Magnum Bonum ..	0	0	0	5	0	5
Robin Adair	0	2	0	2	0	4
Aucklander (unspecified)	0	2	0	1	0	3
Pink Beauty of Hebron	0	0	1	2	0	3
Sutton's Supreme ..	0	2	0	1	0	3
Endurance	0	0	1	2	0	3
Early Puritan	0	2	0	0	0	2
Early Rose	0	0	0	1	0	1
White Beauty of Hebron	0	0	1	0	0	1
Early Regent	0	0	0	0	1	1
British Queen	0	0	0	0	1	1
Northern Star ..	0	0	1	0	0	1
Gamekeeper	0	0	1	0	0	1
King Edward ..	0	0	0	0	0	0
Totals	6	19	22	65	26	138

It will be seen that Dakota heads the list, and it is evident that there is a definite move on the part of growers to reinstate the popularity of this variety by the production of pure strains. It is most extensively grown between the Rangitata and Rakaia Rivers, and to a lesser extent between the Rakaia and Waimakariri. Aucklander is confined almost entirely to the area north of the Waimakariri, where it is extremely popular. Arran Chief is fairly uniformly distributed over Canterbury, and is extensively grown on the heavier potato-land of South Canterbury. Up-to-date and Bresee's Prolific have been sent in almost entirely from the area between the Rakaia and Waimakariri. This localization of varieties illustrates to some extent the effect of one or two enthusiastic growers specializing in the production of high-class pure seed. Other growers in the vicinity, realizing its value, procure their requirements from this source, and there springs up in that area a group of farmers raising high-class seed of one or two particular varieties.

It is to be regretted that the St. Andrews-Willowbridge-Waimate area is not better represented. This is partly accounted for by the fact that certain varieties for example, Majestic, New Era, Perfection, and Britain's Best, which are very popular in this district—were not considered to be of sufficient importance for inclusion in this year's scheme. Some, if not all, will be included in future years.

Certified growers are reminded that their crops will be inspected when in flower. The second field inspection will be made when the shaws are maturing, and the final tuber inspection when the seed has been graded.

THE WILD PIG NUISANCE.

POISONING TRIALS IN WELLINGTON LAND DISTRICT.

D. MUNRO, Principal Inspector, Live-stock Division, Auckland.

DURING the years immediately succeeding the War period wild pigs made their presence felt to a greater extent than previously, more particularly on North Island back-country farms adjacent to extensive bush areas and deteriorated holdings going back to scrub and fern. Doubtless this was largely due to the fact that during the War wild pigs, like the rabbits, enjoyed a period when their increase was more or less unrestricted, owing to the demand made on the man-power of the Dominion. From these areas the pigs came out in great numbers at certain times, more particularly in the early lambing season, when the berry-supplies give out in the bush. On a number of farms the loss of lambs from wild pigs was so heavy that the settlers concerned found it impossible to profitably continue the raising of lambs and were forced to rely entirely on dry sheep.

Without a first-hand knowledge or ocular demonstration it would be difficult to appreciate the extent of damage or loss suffered by settlers in pig-infested areas. The loss of grazing due to damage of pastures by rooting, damage to fences, &c., is very considerable. In certain districts the areas rooted up in a manner resembling rough hillside ploughing would in the aggregate represent hundreds of acres, and the losses became so pronounced that the matter was eventually brought prominently under notice of the Department of Agriculture. The Government recognized that some measure of relief was due to the settlers suffering from the nuisance, and it was decided to offer a bonus of 1s. per snout for wild pigs destroyed. The snouts were collected by reliable settlers in the several districts, who in turn handed them over to a representative of the State Forest Service, who made the final count and paid out the bonus.*

Notwithstanding the great number of pigs paid for, I believe it would be no exaggeration to say that not more than 70 per cent. of those killed came into account. Many pigs fatally wounded are lost in the bush, and for various reasons numbers of snouts collected are never presented for payment. On each occasion when the payment of the bonus was temporarily discontinued owing to the vote being exhausted thousands of snouts were held by settlers, pig-hunting sportsmen, and Maoris, and these were eventually thrown away or destroyed.

After payment of the bonus for two seasons it appeared that little or no impression was being made and that the pigs were as numerous as ever. It was then considered desirable to carry out experiments with poisons, in the hope of discovering a quicker or more wholesale method of destruction. Consequently, being stationed at the time in a district comprising considerable areas of pig-infested lands, the carrying-out of such experiments was entrusted to me.

* The numbers of snouts paid for in the Wellington forest-conservation region for the two years 1925–26 and 1926–27 were 17,227 and 23,282 respectively. In the Rotorua region 2,026 and 4,566 snouts were paid for during the same period.

Prior to this I had for many years had ample opportunity of observing the habits of wild pigs, and had noted that the latter differed in marked degree from the domesticated pig and the majority of wild animals in that they have no fixed place of abode but roam over great areas, influenced almost entirely by the available quantity and variety of their food-supplies. Having cleaned up the supply of fern-root in a certain locality they may not return again in any numbers for several months, as the fern does not readily recover. These irregular roaming habits therefore add to the difficulty of successful poisoning. If the homing instinct of deer or rabbits were more highly developed in wild pigs it might be possible to accustom them to certain foods to which poisons could be added later.

In certain places on the Wanganui River, about old Maori settlements, numbers of fruit-trees still grow, and the fruit which falls to the ground is readily eaten by more or less wild pigs. I therefore concluded that it would be no difficult matter to successfully poison wild pigs by treating apples, quinces, potatoes, or carrots with suitable poisons. It was disappointing to discover later, however, that the taste for such desserts developed by pigs which had come in closer contact with settlement had not been generally acquired by the less enlightened majority, and that anything new or foreign to their surroundings at once aroused their suspicions, after which they avoided the places where these baits were laid.

Information gathered from settlers in different localities relative to the feeding habits of wild pigs differs considerably, which is no doubt due to the reason just stated—that their tastes vary a good deal according to the locality in which they have been bred and the extent to which they have become familiar with settlement. It is fairly generally admitted that poisoned meat—carcases of sheep, cattle, or horses—can be used with some degree of success, but the settlers almost without exception decline to use meat baits owing to the danger of poisoning valuable dogs. The owners of land on which I desired to carry out experiments requested that such baits should not be used. I therefore confined myself to materials which would not be dangerous to dogs—namely, apples, artichokes, carrots, potatoes, oats, barley, peas, and phosphorized pollard.

It is claimed by persons who have had experience of wild pigs in rabbit-infested country that they readily take the poisons laid for rabbits. It would hardly be disputed that phosphorized grain and pollard laid on rabbit-infested country does destroy large numbers of pigs, but I am very strongly of the opinion that this is brought about through their eating the dead rabbits, including the paunch and intestines which contain the fatal dose. Such, at least, has been my experience. An examination of the dead pigs will almost invariably show the stomach to contain quantities of rabbit-flesh. I should hesitate to say that in some places the pigs would not eat the grain or pollard direct, but it may be held as a rule that they become casualties through eating the rabbit carcases.

The Poisoning Trials.

In November, 1926, I visited several farms situated on the Wanganui River, but in most cases it was found that the pigs had suddenly disappeared from the more open country and had moved well back into

the dense bush, where it is rather difficult to follow them with poisons. However, on one extensive property situated a few miles inland from the river a number of pigs were located, and there was a good deal of fresh rooting and well-defined pig-tracks. This place was well suited for experiments, there being several open grassy clearings in the bush, and here poisons were laid. The following notes give particulars :—

Clearing No. 1 : Some half-grown pigs seen here, also a good deal of rooting and other fresh traces. Laid carrots, potatoes, and artichokes treated with strychnine—$\frac{1}{3}$ to $\frac{2}{3}$ grain let into each bait.

Clearing No. 2 : A good many fresh tracks and plenty of fresh rooting. Laid phosphorized pollard as prepared for rabbits.

Clearing No. 3 : Fresh rootings and several well-defined fresh pig-tracks. Laid potatoes, artichokes, and carrots into which plugs of phosphorized pollard (double strength) had been inserted.

Clearing No. 4 : Plenty of fresh rootings and well-defined regular tracks. Laid potatoes, artichokes, apples, and carrots treated with arsenic—$\frac{1}{4}$ grain per bait.

All the clearings were visited the following afternoon, but none of the baits had been disturbed and no new rootings could be seen. The manager of this property undertook to watch results, and from reports received later it would appear that the pigs avoided the clearings mentioned after the poisons had been laid.

At Otumango, about twenty-five miles up-river from Pipiriki, on a vacated farm, pigs were found to be very numerous, and the property was very suitable for purposes of experiment. The whole of the cleared land, between 300 and 400 acres, was rooted up, and it was quite evident that large numbers of pigs were about. In a large basin fringed by standing bush thirty to forty full-grown pigs were seen grazing on the young grass. In order that they might not be disturbed we waited till they had finished feeding, when they retired into the bush. On closer observation it was found that a great number of pigs regularly frequented this basin.

We therefore proceeded to lay out in plots a variety of poisoned baits previously prepared, each variety being laid separately ; in other places similar baits were laid to which no poison had been added, to act as a check against those treated. More poison was laid in similar manner at different parts of the farm, the total area poisoned being approximately 130 acres. The party then retired on to a high point overlooking most of the ground where the poisons had been laid. During the afternoon three pigs which had come out unobserved evidently found some of the baits, as we first noticed them racing back to the bush. About ten minutes later another three full-grown pigs came from the bush along a low ridge to a place where some poisoned apples had been laid. With my glasses I could see quite clearly the apples on a track. On reaching the apples the leading pig stopped, smelt one, stood for a few seconds, and then fled back to the bush followed by the others. Soon after this an old boar came from the bush by another track, travelling down towards the basin. He also came to an apple, which he smelt, and stood for a few seconds in silent meditation ; then, shying past the bait, he ran down the basin to where a patch of artichokes had been laid. Here he became quite alarmed, shying about like a young colt, and eventually bolted across the valley, making for the bush in the

opposite direction from which he had appeared. Four half-grown pigs were then seen to approach from the bottom of the valley; they crossed a stream and commenced to graze below where a patch of phosphorized pollard (rabbit poison) had been laid. They gradually worked up the valley till the leading pig reached the poison, when he stopped and looked at it; the others, 10 or 12 yards away, immediately ran up and stood for a few seconds as if in consultation, then broke, bolting back across the stream, disappeared in the scrub, and were not seen again.

Six different lots of from three to six pigs were noticed coming from different points. Some came well down into the basin before they reached the poisons, but in every case as soon as they came on any of the baits they immediately took fright and raced back to cover. At dusk we returned to camp. During that night very heavy rain fell which should have removed any smell of our hands that might have attached to the baits handled.

The following afternoon we returned to the observation point, from where we soon observed a party of three pigs come from the bush. They grazed for a time, gradually working downhill till they reached the treated area. Here they came on some apples, carrots, and artichokes which had *not* been treated with poison. They at once took fright, behaving in a manner similar to that already described. The appearance of these things, new or foreign to their natural surroundings, evidently filled them with suspicion, and they at once made for cover. At another point an old sow with a litter of five suckers came on to a patch of artichokes and apples. She was less timid than the others, but after a few minutes she also became very uneasy, and, gathering her family, departed somewhat hurriedly for the bush.

We continued to observe results on six days after the poisons had been laid, but after the second day no pigs ventured on to the poisoned areas. All the plots were carefully examined; several baits were missing, but this I attributed to sheep dislodging them, when they would roll down the steep slopes. In any case our search failed to reveal any dead animals.

On our arrival at Otumango homestead it was noticed that a patch of potatoes, evidently left by the previous owners, had been rooted over by pigs, and that the tubers were left untouched, evidence that they had not acquired a taste for this class of food. I was later informed by settlers and Maoris that although pigs frequently rooted the potato patches they did not readily eat the tubers.

Our experiments completed at Otumango, other properties were visited, but it was found that the pigs had moved back into the bush. It was therefore decided to abandon further efforts till a later season, when the pigs would have returned to the more open country.

The investigation was again taken up during the winter months, and an effort made to poison the natural food-supplies—wild berries. This proved a failure also, for the reason that the season had produced an abnormal crop, the whole of the bush-lands being literally carpeted with berries, and it was extremely difficult to detect the places where the pigs were feeding. Further trials were also made with grain, peas, beans, and pollard poison treated with aniseed oil, but in every case the results were similar to those already described. Nature appears

to have developed in the pig in its wild state a suspicious caution which is totally absent in the domesticated breeds.

Experiments were also carried out in Kaitieke County, with results very similar to those obtained on the Wanganui River lands. Mr. G. Millar, Stock Inspector at Taumarunui, who conducted these trials, supplied the following particulars :—

Having selected for experimental poisoning a property situated near a belt of bush, we soon found a well-defined pig-track leading out of the bush on to the clearings. On this we laid five baits of horseflesh of about 2 oz. with cubes of pollard poison inserted in the middle. The baits were laid about 5 yards apart on the track; other baits were laid on tracks leading through or under fences, and others again on fresh rootings about 300 yards distant from the first.

The baits were not examined for three days, when it was found that those laid on the rootings had not been disturbed. There were no fresh pig-marks about. Further on we picked up the fresh tracks of a large pig leading to where other phosphorized meat baits had been laid, and it was quite noticeable that the pig had stopped at and examined the baits but passed on without touching them. The baits laid on tracks alongside the fences were also untouched. In another place, where five baits had been laid, one was missing, another was moved about 3 yards, and the remainder were untouched.

We proceeded to another locality where pigs are fairly numerous, and we had no difficulty in picking up well-defined, freshly used pig-tracks. Here we laid a dozen meat baits poisoned with strychnine at a distance of from 6 to 10 yards apart, each being marked by a turned sod near by. Sixty yards farther on more meat and pollard poison was laid. In another place several more baits were laid, both strychnine and phosphorus being used. Some 400 yards distant, in a gully, another patch of poison was laid.

Three days later, on examining the various plots, it was noticed that nine out of twelve meat baits (strychnined) and two out of twelve phosphorized-pollard baits were missing. In another place three out of twelve strychnine baits (meat) were missing. The rest of the meat and pollard baits were untouched. No dead pigs could be found. The country is rough, with very dense fern. In all, only two out of thirty-four phosphorized-pollard baits were missing, while out of sixteen strychnined meat baits laid twelve were missing. The owner of the property reported that some days later his dog found one of the missing meat baits some distance from where it had been laid.

The result of these trials appears to confirm what had already been noted in previous experiments. Small meat baits are liable to be carried away by birds or cats, and left where later a dog may pick them up. In using meat it would probably be safer to use a large joint that could be securely anchored, and later destroyed if not eaten.

Conclusion.

On the occasion of my last visit to pig-infested country on the Wanganui River, during the past spring, a very decided decrease in the number of pigs was noticeable. This was confirmed by reports from several settlers, who stated that there were no pigs about this season. Asked if they could state the reason why, it was at once suggested that the war waged on them in connection with the bonus was principally responsible. I am also inclined to the opinion that the payment of the bonus has produced very much better results than was formerly realized; further, that if the same pressure is maintained the wild pig nuisance will in a few years be reduced to a point when it will cease to be a menace as in recent years.

So far as our experiments have been carried, it would appear that the more direct method of destruction—by knife, gun, and dogs—is a surer means of dealing with the wild pig nuisance.

THE BLACKBERRY PEST.

CONTROL—*continued.*

E. F. NORTHCROFT, M.Sc., Biological Laboratory, Wellington.

(1) CHEMICAL INVESTIGATION.

METHOD OF ELIMINATING INEFFECTIVE COMPOUNDS.

PRIOR to the establishment of the field experimental station near Wairoa a considerable amount of work had been carried out at the Biological Laboratory, Wellington, in the testing of chemical compounds. The usual method of tip dipping was adopted, and by immersing the blackberry shoots in solutions of varying strengths a positive or negative effect could be obtained. In this way over ten thousand tests were made, representing a great many compounds and mixtures of compounds. As far as it was possible and practicable to do so, every known plant poison, either alone or in combination, was employed, irrespective of the cost factor. Following is a list of some of the most important :—

Hydrochloric acid.	Formalin.
Nitric acid.	Ammonia.
Acetic acid.	Carbon bisulphide.
Carbolic acid (phenol).	Hydrogen sulphide.
Xylol.	Mercuric chloride.
Methylated spirits.	Cupric sulphate (bluestone).
Turpentine.	Cupric chloride.
Benzene.	Copper acetate.
Kerosene.	Lead nitrate.

Arsenious oxide (As_4O_6), in combination with one or more of such compounds as potassium or sodium hydroxide, sodium bicarbonate, sodium carbonate, sodium chloride, and sodium nitrate.
Arsenic oxide (As_2O_5) alone and in combination with sulphuric acid.
Arsenic oxide in combination with inorganic acids.
Zinc sulphate.
Magnesium sulphate.
Barium chloride.
Potassium hydroxide, potassium chloride, and potassium nitrate—alone and in combination with each other.
Sodium chloride, sodium carbonate, sodium hydroxide, and sodium nitrate—alone and in combination.
A number of proprietary specifics.

Hydrochloric acid, &c., was used in proportions varying from 1 to 10 per cent.

From these compounds the most effective, or those which showed any signs of causing considerable withering or injury to the stem or leaves of the blackberry, were selected, and then carefully tested on a field scale at the experimental station.

Arsenic Compounds.

Regarding the compounds with arsenic as the principal element, the following were used :—

(1) Arsenic oxide, or arsenic pentoxide (As_2O_5), as it is more generally known: This poison is not formed directly from the element arsenic by combustion in oxygen, as is the case with phosphorus, but by means of the use of oxidizing agents on arsenious oxide. If arsenious

oxide (As_4O_6) is digested with nitric acid, arsenic acid ($2H_3AsO_4,H_2O$) is formed, from which the anhydride can readily be obtained. On the experimental plots arsenic oxide was used (*a*) alone in concentrations from 0·5 per cent. up to 10 per cent.; (*b*) with sulphuric acid, using arsenic oxide and the acid in varying strengths from 1 per cent. up to 10 per cent.; and (*c*) with hydrochloric acid. It was found that where the higher percentages of acid were used the damage was so rapid that the permanent effect was anything but good; hence the later strengths were not carried as far as the 10 per cent., but varied according to the compound used, the strengths being determined by the early experiments.

(2) Arsenious oxide (As_4O_6): This is one of the most important compounds of arsenic, being known in commerce as white arsenic, or simply arsenic. It is a very violent poison, 0·06 gramme being a dangerous dose and 0·125 to 0·25 gramme fatal. The repeated use of arsenic renders one immune to much larger doses; amounts as great as 0·3 gramme can be consumed by arsenic workers in Styria. They hold that it acts as a cosmetic, and also improves the breathing in mountain-climbing. The antidote is freshly precipitated ferric hydroxide, or a teaspoonful of mustard with a tablespoonful of salt in a glass of warm water. Arsenious oxide is a very fine white powder, not easily wetted with water, in which it is very sparingly soluble; at a temperature of 15° C. 100 grammes of water dissolves only about 1·65 grammes, and the solubility is only slightly greater with boiling water. If the oxide is boiled with sodium or potassium hydroxide, carbonate, or bicarbonate, the meta-arsenite of sodium or potassium is formed. For example, if required quantities of arsenious oxide and caustic soda are boiled, sodium meta-arsenite ($NaAsO_2$) and water are formed according to the equation $As_4O_6 + 4\ NaOH = 4\ NaAsO_2 + 2\ H_2O$. Many people seem to think they have for a long time been using this sodium meta-arsenite as a spray under the name of arsenite of soda; but the composition of that specific is anything but constant, and though it contains a certain amount of meta-arsenite of soda it is more correctly a solution of arsenious oxide in sodium hydroxide; it is this which has been found to have an extremely caustic effect on the foliage and green parts of plants.

In the experiments very many strengths of arsenious oxide dissolved in various proportions of sodium hydroxide or sodium carbonate, and also in various mixtures of sodium hydroxide and sodium chloride, were used. Sodium meta-arsenite was used in proportions from 1 per cent. to 10 per cent. The arsenic solutions were as follows:—

Arsenic pentoxide and potassium cyanide.
Arsenic pentoxide and potassium nitrate.
Arsenic pentoxide and sodium chloride.
Arsenic pentoxide and hydrochloric acid.
Arsenious oxide and sodium hydroxide.
Arsenious oxide, sodium hydroxide, and chloride.
Arsenious oxide, sodium hydroxide, and nitrate.
Arsenious oxide and hydrochloric acid.
Arsenious oxide and sodium chloride.
Arsenious oxide, sodium hydroxide, and potassium cyanide.
Arsenious oxide and sodium carbonate.
Arsenious oxide, sodium carbonate, and sulphuric acid.
Arsenious oxide, sodium chloride, and hydrochloric acid.
Arsenious oxide, sodium carbonate, and sodium chloride.

No attempt can be made here to give the various proportions in which the compounds were used, but none was over 10 per cent. or under 0·5 per cent. After selection from the chemicals and groups of chemicals in the above list, the following were tried as sprays on a large scale, together with compounds in the form of a vapour or solid. These latter were not previously referred to, as they had not been tested in any way in the laboratory.

Solutions.

Arsenic oxide.	Sodium meta-arsenite.
Arsenic oxide and sulphuric acid.	Sodium hydroxide and sodium carbonate.
Arsenic oxide and hydrochloric acid.	Sodium hydroxide and sodium nitrate.
Arsenic oxide and sodium nitrate.	Hydrochloric acid.
Arsenious oxide, sodium hydroxide, and sodium nitrate.	Sulphuric acid.
Arsenious oxide and sodium hydroxide.	Nitric acid.
Arsenious oxide, sodium carbonate, and sodium chloride.	Sheep and cattle dips.
	Proprietary mixtures.

These, also some others not included in the list, were all tested in the field at concentrations of 5 per cent. and 2 per cent., so as to enable a quick and rough comparison, and thus make some selection before going on to investigate the effect of each combination at the various strengths.

Gases.

Hydrogen sulphide.	Arsenious chloride.
Carbon bisulphide.	Chlorine.
Sulphur dioxide.	

Solids.

Sodium hydroxide.	Ferrous sulphate.
Sodium chloride.	Potassium cyanide.
Lime.	Calcium cyanide.
Sodium carbonate.	Superphosphate.
Sodium nitrate.	Basic superphosphate.
Cupric sulphate.	Basic slag.
Cupric chloride.	Ephos basic phosphate.

The Experimental Station and Field Work.

As mentioned in the preceding article of this series, the experimental station, near Wairoa, comprises an area of 40 acres, covered for the most part with tall dense blackberry which had been left untreated for a number of years. The year previous to the establishment of the station the bushes had flowered and fruited freely.

Under the method of subdivision decided upon the plots were made as large as could be afforded with the comparatively limited area available. The hillside blackberry adjacent to the store-shed was reserved for spraying experiments; the blackberry on the flat or gently sloping land was marked off into plots of convenient size to test those chemicals used in the solid form; while poisonous vapours were tested at the top of the section, and, for the sake of safety, well away from the road, dull, still weather being chosen.

TESTS WITH GASEOUS POISONS.

The gases used were sulphuretted hydrogen, carbon bisulphide, sulphur dioxide, arsenious chloride, and chlorine. In the manipulation

of these very great care was necessary, especially with arsenious chloride, which is a deadly poison, and one could be guided only by sense of smell as to how long it was advisable to remain in the area when applying the vapour. As there were no proper facilities on the section for the careful testing and confining of these vapours they could only be used under the most restricted conditions. In each case they were used before sunrise, as the atmosphere was most steady at that time. Under the conditions the vapours were used all that can be said is that they were ineffective. On a small scale they could be tested in confined areas, where the results would necessarily be very much better than the field experiments showed. However, it would be quite impossible from most points of view (especially cost) to carry out such experiments economically on a large scale.

TESTS WITH SOLIDS.

As already stated, the chemicals and mixtures used in the solid form were all applied on land which was either flat or very gently sloping. The blackberry was cut as close to the ground as possible, and the solid then sprinkled on at the rate of $\frac{1}{2}$ lb. to each square yard. All solid chemicals were applied during the winter of 1925, which was an unusually wet one. By the spring all the plots had shown vigorous and healthy growth, and at no time since have any of the shoots looked at all sickly. At the rate of $\frac{1}{2}$ lb. of solid per square yard 1 acre of land would require approximately 1 ton of the solid; and if arsenic pentoxide, which costs 84s. per hundredweight in Melbourne, were used, the total cost of material alone would be £84.

SPRAYING TESTS.

The plots for spraying tests were made as far as possible square, each being from $\frac{1}{80}$ acre to $\frac{1}{40}$ acre in area. At first the plots were regularly marked off with a track of about 1 yard wide, cut so as to mark off each block more clearly; but it was soon found that too much time was lost in properly marking off plots and keeping them defined in this manner. Consequently plots of convenient size were measured, the shape and size depending more or less on the line taken by the bushes, as much use as possible being made of any natural or stock tracks, in order to avoid cutting through a bush and so leaving half in one plot and half in another, each sprayed with a different mixture.

Methods of Experiments, &c.

The experiments were carried out at first in series of four at each strength of each compound or mixture. Four sprayings with each specific were necessary, the plots being treated as follows:—

(1) Sprayed on plots of standing blackberry.
(2) Sprayed on a second plot of standing blackberry.
(3) Sprayed on plot which had been cut and the blackberry removed so that the spray could reach the crowns and cut stems.
(4) Sprayed on plot after the blackberry had been cut and burnt *in situ*.

Each plot received the same treatment—was sprayed the same day and under the same conditions, all plots of the same area receiving the same volume of liquid—the volume being determined by the amount

required to thoroughly spray the plot of cut blackberry. In actual practice more solution was required to spray the cut plots than to thoroughly spray the standing bushes.

In each case there were two plots of standing blackberry sprayed, the reason being that the subsequent treatment of these plots was different. One was burnt when the new shoots were beginning to develop, and the other was not burnt until the shoots had well developed. This gave four plots at the second spraying, with the growth of shoots showing some considerable variation. The condition in the plot of standing blackberry which was simply sprayed was much the same as in the two plots which were cut before spraying, but the plot of standing blackberry which was sprayed and subsequently burnt did not attain the same amount of growth, because it was at least a month behind the others.

On making observations in 1926 from a number of plots sprayed in 1925 it was found that there was no advantage to be gained by any preliminary treatment before the spraying was carried out. The cutting of an acre of average blackberry costs from £4 10s. to £6, and added to this would be the cost of removing the dried tops before any chemical could be applied, thus entailing a large expenditure. Hence the total cost of labour plus specific would be very high—in fact, much higher than most land could stand. In the one case there is the cost of cutting and clearing plus cost of specific and application of same, while in the other is the cost of specific and application of same plus cost of burning. The treatment in the latter case showed much better results, and in addition the total cost of treatment was much lower.

Fortunately, it was found that as regards efficiency of the spray the best method was to treat the standing bushes, then leave them as long as possible—the longer the better. The best results were obtained when the plots could be left until new shoots had made some good growth before the plot was fired. Too great a risk should not be taken, however, for it must be remembered that a bad fire is far worse than no fire at all, and for the sake of safety it is better to burn when shoots are small than to take the risk of a bad burn.

During the period from June, 1925, to March, 1927, in which the field-work was conducted by me, many plots were discarded, and many new compounds and concentrations of the ingredients of used compounds altered from time to time. Where similar or nearly similar substances were being used, such as the various forms of arsenic, an endeavour was made to treat in the one day all the plots with the concentration, at 1 per cent., for the purpose of getting the relative values of the different mixtures, as explained later.

The total number of plots treated on the experimental area is very considerable, though the number was never constant for any period. The greatest number under treatment at any one time was 110, and that was more than enough for one person to have to make observations on as well as treat from time to time. At present there are only forty-nine plots, and it will not be necessary to experiment further even with all of these.

Spraying-apparatus.

Several types of spray-pumps have been used, including atomizers, force-pumps, bucket pumps, syringes, and knapsack spray-pump such as the Eclair Vermorel and Hollands. My experience was that the Eclair

Vermorel lasted longer than others and did not go out of order nearly so easily, besides being the only really safe knapsack sprayer for an operator using specifics of a poisonous or corrosive nature. The nose-piece was found to be a disadvantage, however; by means of the pump a good pressure could be developed and maintained, but on account of the construction of the sprayer it was not capable of making the maximum use of the pressure and would throw the liquid only a short distance, the liquid leaving the exit as a hollow cone and not in the shape of a fan. The most efficient arrangement was an Eclair Vermorel knapsack spray-pump from which I had removed the nozzle and replaced it with an adjustable one, fan-shaped. This type of spray-pump proved more efficient and economical and a better time-saver than the atomizer type, which requires the maintenance of a definite pressure to force the liquid through and deliver it in the form of very fine particles. A series of comparative tests was made with the best atomizer (one specially imported for this work), and from the viewpoint of time required for manipulation and carrying out the spraying it could not compete with the Eclair Vermorel. With the atomizer it would take a man working alone just over ten hours to spray an acre of dense blackberry—this time being the average of a number of tests which were made. Using an Eclair Vermorel to which had been fitted a fan nose-piece a man working alone would require two and a half hours of actual spraying-time to treat a similarly dense area.

Spraying-compounds.

Numerous chemical compounds and combinations of such compounds applied in the form of a spray have been tested thoroughly in the field, but up to the present no chemicals have been found which can kill the blackberry-plant. The root in some instances can be killed to a short distance underground, or the crown may be destroyed; but the plant can very readily send forth new strong shoots from below (see *Journal* for June last, pages 383-385), and not until a compound is found that can penetrate and travel along to the vital tissues in the root can there be any hope of eradication by means of a chemical.

Many chemicals, including arsenic compounds and arsenic with other compounds, &c., have a certain amount of value for withering the foliage and thus facilitating good, clean burns. Among these may be specified the following:—

Arsenic oxide.
Arsenic oxide and sulphuric acid.
Arsenious oxide and sodium hydroxide.
Arsenious oxide, sodium hydroxide, and sodium nitrate.
Arsenious oxide, sodium hydroxide, and sodium chloride.
Arsenious oxide, sodium carbonate, and sodium chloride.
Sodium meta-arsenate.
Sodium carbonate and sodium hydroxide.
Sodium nitrate and sodium hydroxide, &c.

But so far none of these compounds, used in any strength which could be applied economically, has been of the slightest use in really eliminating blackberry. The great advantage to be derived from the use of chemicals is enabling the farmer to get good, clean burns, and by this method doing away with the necessity of cutting large areas. The cost of cutting blackberry is extremely high in the affected districts, and it is

frequently impossible to get men to undertake the work if there is employment of any other kind available.

In all the specifics which showed any signs of being effective the constituent compounds (when they consisted of more than one chemical) were used in all concentrations from 1 per cent. up to 10 per cent., the amount of solvent remaining constant. To take a simple example, sodium nitrate was used with sodium hydroxide in the following proportions :—

$NaNO_3$	(1) NaOH	(2) NaOH	(3) NaOH	(4) NaOH	(5) NaOH	(6) NaOH	(7) NaOH
1	1	1·5	2	2·5	3	4	5
1·5	1·5	2	2·5	3	4	5	1
2	2	2·5	3	4	5	1	1·5
2·5	2·5	3	4	5	1	1·5	2
3	3	4	5	1	1·5	2	2·5
4	4	5	1	1·5	2	2·5	3
5	5	1	1·5	2	2·5	3	4

In the case of all specifics it was found that the higher percentages were no advantage when used as a spray, the best results being obtained from concentrations lower than 5 per cent. The reason probably is that with the higher concentrations the effect is too rapid, and with all it would seem that slower action is preferable. With strong solutions the burning is so rapid and complete that withering and drying set in immediately, and consequently if there is any chance of even a little of the poison getting into the vital stream and being carried down it is lost on account of the strong corrosive action and consequent rapid sealing. Where the action is much slower one finds the effects more extensive. The leaves first of all develop a few spots, frequently as long as twenty-four hours and sometimes two or three days after the application of the spray ; then the spot gradually enlarges, till eventually the leaves attain a brownish appearance ; but it is still some time before they commence to shrivel up and dry. It is more than likely that during this slow continuous withering process a small amount of the poison may be able to find its way into the downward current and so affect the more distant parts of the plant.

Though a fair number of proprietary specifics were thoroughly tested, none was found to compare at all favourably with other compounds referred to.

SPRAYS OF GREATEST EFFICIENCY.

Of all the sprays used there is no doubt that the most effective and those with the greatest lasting-powers—giving the plant the maximum shock—are (1) arsenic oxide (As_2O_5) or arsenic pentoxide, and (2) arsenious oxide (As_4O_6) (white arsenic) with sodium hydroxide (NaOH) (caustic soda). Both are deadly poisons, the pentoxide being easily soluble in cold water, whereas the trioxide or white arsenic is only very sparingly soluble in the same medium. In sodium hydroxide the arsenious oxide is easily soluble, and this has been frequently used as a spray for all kinds of weeds. The two compounds were used for blackberry in all sorts of proportions and in many different strengths, the most favoured one being 2 lb. arsenic, 3 lb. soda, and 10 gallons water.

As a weed-killer the so-called sodium arsenite has frequently been used on railway tracks, especially in America, and it is generally advocated

for weeds by agricultural stations in different parts of the world. The most frequent formula given is 1 lb. white arsenic to 2 lb. sodium carbonate and from 3 to 9 gallons water. This killed most weeds fairly effectively, though by some it is claimed that if pure arsenite of soda is used diluted with from 4 to 8 gallons of water a much better weed-killer is obtained.

It has generally been claimed that arsenic compounds ruin the soil, but in articles in the *Biochemical Journal* for 1913 and in *Centralblatt Bakteriologie Abteilung* for 1914, on the influence of arsenic upon the biological transformation of nitrogen in soil, nitrogen-fixing power, and bacterial activities in the soil, it has been shown that water-soluble arsenic may exist in as much as 82 parts in 1,000,000 without hindering ammonification and nitrification processes—lower concentrations acting as stimulants. To quote one passage: "The greatest stimulation was noticed when the concentration of water-soluble arsenic in the soil was 10 parts in 1,000,000. The bacterial activities of the soil were checked only with enormous quantities of arsenic. Small amounts stimulated soil bacteria and caused the liberation of the soluble plant-food materials, especially phosphorus." The effect of arsenic in the soil on many plants is to stimulate, and many plants have been found to contain quite considerable quantities of arsenic and still remain healthy.

On animals arsenic has a toxic effect. The use of arsenic constitutes a certain danger to stock, for farm animals, especially cattle, on account of the brackish sweet taste, are attracted to the sprayed plants, and in this way they may easily secure a fatal dose. The lethal dose has been estimated as follows: For a horse, 1·9 grammes; for a cow, 0·64 gramme; for a dog, 32–64 milligrams. It has been stated, further, that poisoning of cattle cannot occur through eating grass that has taken up arsenic from the soil through the roots. It has, however, been shown by Gorup-Bezanez that if arsenious acid is mixed with earth and plants are grown in such earth they only absorb infinitesimal quantities of arsenic.

In the *Journal of the American Chemical Society*, 1908, Swain considers that plants do not absorb enough arsenic from the soil to poison animals. In the 25th Annual Report of the United States Department of Agriculture, 1908, Formad proved arsenic *deposited on* pasture grasses to be a great menace to animals. He found arsenic present in grass and hay in amounts varying from 0·02 and 0·1 milligram of arsenious acid per gramme of dry sample. Cattle, horses, and sheep feeding on this died in great numbers and showed all symptoms of arsenic poisoning. On analysis arsenic was found in all parts of the animal tissues. However, this should not be a very serious difficulty in the way of the use of arsenic compounds for spraying, because it is an easy matter to add some such repellant as potassium xanthate ($SC{-}SK{-}OC_2H_5$). This need only be added to the spraying-solution in quite small quantities, and it will, I am confident, most successfully keep stock well away from the sprayed bushes. Here it might be mentioned that it is quite often a good plan to add some substance which will remain in very fine suspension in the spraying-fluid, as this will dry on the leaves and so show clearly where the bushes have been sprayed, and in this way obviate the liability of unnecessary repetition. For instance, when

FIG. 22. BLACKBERRY-BUSHES ON ARSENIC AND SODA PLOT BEFORE SPRAYING.
The rule standing in centre is 6 ft. long.

FIG. 23. THE SAME PLOT AFTER TREATMENT.
The vertical rule-arms are 6 in. long.

[Photos by the Writer.

(See pages 380–382.)

spraying in situations near the sea it is easy to use sea-water in mixing the solution; when this dries a white deposit is left on the leaves, clearly marking the sprayed bushes from the others.

Experiments have been carried out to ascertain the rate of leaching of sodium arsenite from soils. Samples were taken from round a blackberry-bush which had been thoroughly treated with arsenite of soda. At first the percentage present was 0·68, but after a period of twelve months had elapsed analysis showed only 0·04 per cent. The method of mixing was as a rule as follows: The arsenic was mixed with a little of the water to a paste; then more water was added, and all brought to the boil. After boiling some time the container was removed from the fire and the soda was added. When all was dissolved it was diluted to the required strength. It was not until after the completion of a great number of laboratory and field tests that I was able to work out the most efficient and economical formula for the harder, more woody plants. This consists of 1 lb. of white arsenic to 1¼ lb. of 98 per cent. fresh caustic soda. The great advantage gained with this is in the method of mixing, for artificial source of heat is not required—a fact of great advantage if the materials have to be mixed out in the field, where not only is it very difficult to make a fire, but also inconvenient and necessitating a considerable loss of time. This method is as follows: Mix the arsenious oxide and sodium hydroxide (which must be fresh—about 98 per cent.) dry; then add a little water—sufficient to make a paste—stirring thoroughly with a stick; as soon as it commences to bubble run in a little more water, but not sufficient to stop the bubbling; when bubbling has ceased the full quantity of water may be added. Care must be taken to stir thoroughly and also to keep well away from the fumes, which are of a very poisonous nature.

Later I altered my original formula to one containing 1 ton of white arsenic and 800 lb. of caustic soda. This formula was found entirely satisfactory, and quite the best arsenic-and-soda formula I have used. Murtons Ltd., of Napier, have now made this up in concentrated form in drums containing 5 gallons, at a price of 8s. per gallon of concentrated specific. This can be used in dilution with water at anything from 1 part in 90 to 1 part in 120. Since 150 gallons are required to spray an acre, the cost at the dilutions 1 : 100 and 1 : 120 per acre is 12s. and 10s. respectively, and the solution would contain about 1 per cent. of arsenious oxide. This is a considerable reduction in price when one considers that some of the best known specifics now on the market cost (even for some of the more moderate) £1 5s. per acre. There is only one other specific at all comparable with the foregoing, and that is arsenic pentoxide, which has been proved to be most efficient in 2 per cent. solution. The price of 1 cwt. in Australia is £4 4s., or 9d. per pound, making the cost of 150 gallons of a 2-per-cent. solution £2 2s. 3d.

If blackberry has to be cleared off a place, obviously spraying and burning is by far the most economical method to adopt. Cutting will cost from £4 10s. to £6 per acre, and a man can only cut 1 square chain per day. An acre of blackberry sprayed with arsenic-and-caustic-soda solutions would cost 12s. for the spray, and a man at

FIG. 24. ARSENIC PENTOXIDE PLOT BEFORE SPRAYING.
This bush was 8 ft. high.

FIG. 25. THE SAME PLOT AFTER TREATMENT.
The rule in centre measures 3 ft.
[*Photos by the Writer.*

(See pages 380–382.)

16s. per day could spray 4 acres, the total cost for this area thus being £3 4s. If these 4 acres had been cut the cost would have been £18 at the least.

Detailed Results from Special Sprays.

Plots sprayed with the arsenious oxide plus caustic soda, and others sprayed with the arsenic oxide, have been kept under observation since the time of the first experiments at the experimental station. At the time the first plots were treated the original "arsenite" formula was being used, and it was not till 1926 that this formula was altered to the more efficient formula given above. In June, 1925, plots were sprayed with the old formula and also with arsenic oxide. In the spring of that year these plots showed a very considerable growth, and were therefore again sprayed in December. In March, 1926, all these plots were examined, and the percentage of shoots on the plots is given in Table 1, only those shoots shorter than 3 ft. being recorded here.

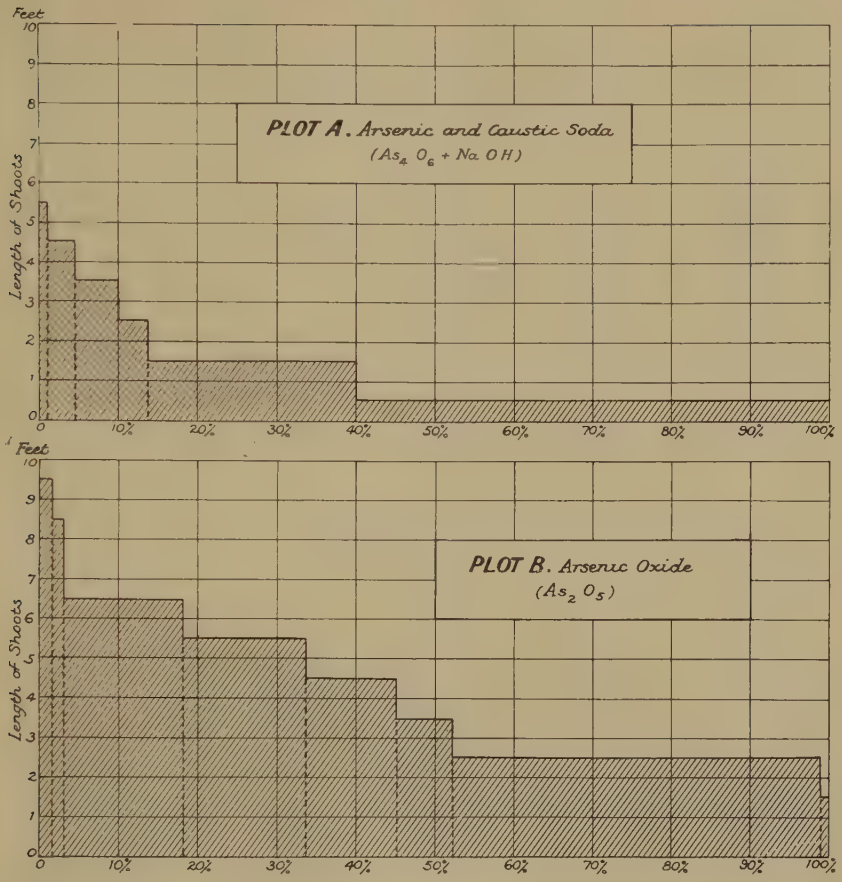
Table 1.

	Strength of Solution.				
	0·5 per Cent.	1 per Cent.	1·5 per Cent.	2 per Cent.	3 per Cent.
Arsenic and caustic soda	69·51	84·61	100·00	83·74	83·33
Arsenic oxide ..	65·57	83·61	90·74	61·83	63·53

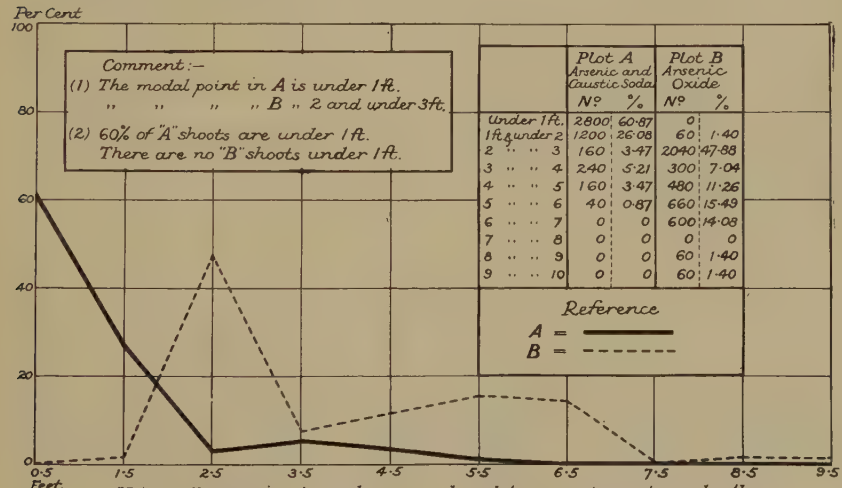
From this table it is seen that the arsenic-and-caustic-soda plot showed much better results than the arsenic-oxide plot, and that there is a gradual rise in effectiveness up to a solution of strength 1·5 per cent., then a slow falling-off. In each case upwards of four thousand shoots were measured and reduced to percentages to make them strictly comparable.

Table 2.

Length of Shoots	Under 1 ft.	Under 1½ ft.	Under 2½ ft.	Under 3 ft.	Under 4 ft.	Under 5 ft.	Under 6 ft.	Under 8 ft.	Under 9 ft.
NEW ARSENIOUS OXIDE AND CAUSTIC SODA MIXTURE—1 PART IN 100 (PLOT "A").									
Number of shoots measured	2,800	1,200	160	240	160	40	0	0	0
Percentage ..	60·87	26·08	3·47	5·21	3·47	0·87	..	..	..
Percentage under 3 ft., 95·63.									
ARSENIC OXIDE—2 PER CENT. (PLOT "B").									
Number of shoots measured	0	60	2,040	300	480	660	600	60	60
Percentage ..	..	1·40	47·88	7·04	11·26	15·49	14·08	1·40	1·40
Percentage under 3 ft., 56·32.									



GRAPHS 1*a* AND 1*b*. SHOWING THE RELATIVE LENGTHS AND PROPORTIONS OF THE BLACKBERRY SHOOTS MEASURED ON PLOT A (NEW ARSENIC-CAUSTIC SODA FORMULA) AND PLOT B (ARSENIC PENTOXIDE) AFTER SPRAYING.


Per Cent
Comment:-
(1) The modal point in A is under 1ft.
" " " " B " 2 and under 3ft.
(2) 60% of "A" shoots are under 1ft.
There are no "B" shoots under 1ft.
Reference
A =
B =
0·5 1·5 2·5 3·5 4·5 5·5 6·5 7·5 8·5 9·5
Feet
Note:- Frequencies in each case reduced to percentages to make them strictly comparable

	Plot A Arsenic and Caustic Soda		Plot B Arsenic Oxide	
	No	%	No	%
Under 1ft.	2800	60·87	0	
1ft. under 2	1200	26·08	60	1·40
2 " " 3	160	3·47	2040	47·88
3 " " 4	240	5·21	300	7·04
4 " " 5	160	3·47	480	11·26
5 " " 6	40	0·87	660	15·49
6 " " 7	0	0	600	14·08
7 " " 8	0	0	0	0
8 " " 9	0	0	60	1·40
9 " " 10	0	0	60	1·40

GRAPH 2. SHOWING FREQUENCIES IN PERCENTAGE OF LENGTHS OF BLACKBERRY SHOOTS ON PLOTS A AND B.

In March, 1926, plots were sprayed with the new formula, which I used diluted 1 part in 100 of water; and for the sake of comparison plots adjacent were sprayed with 2 per cent. arsenic oxide. They were all examined in March, 1927, and up to that time had had only the one treatment, whereas the plots referred to in Table 1 had had two sprayings up to the time of the analysis. Table 2 gives the details of these plots "A" and "B" respectively, and Graphs 1 and 2 afford a clearer idea of the situation. Fig. 22 shows plot "A" (arsenious oxide and caustic soda) before treatment in March, 1926, and Fig. 23 the same plot at the time of examination in March, 1927; the vertical arms of the rule seen in the latter figure are 6 in. long. Fig. 24 shows plot "B" (arsenic oxide) before treatment in March, 1926, and Fig. 25 the same plot in March, 1927, when examined, the rule in the centre being 3 ft. high.

(Series to be continued.)

TUBERCULOSIS IN CATTLE AND PIGS.

THE Director of the Live-stock Division (Mr. J. Lyons) refers to this subject in his annual report for 1926–27 as follows:—

An examination of the whole position as regards tuberculosis in animals in New Zealand indicates that the incidence of tubercular disease in cattle and pigs in New Zealand would appear to be decreasing, although there are still some districts possessing low, wet, and swampy areas where the disease is prevalent to a greater extent than elsewhere, and until better conditions can be brought about by means of drainage, &c., improvement will be difficult in these districts. The condemnations of cattle on clinical examination and as a result of the tuberculin test numbered 4,750, as against 4,692 last year. This constant weeding-out of clinically affected animals must be an important factor in controlling the disease and in gradually reducing its incidence. The Wellington inspection district (embracing all the North Island outside Auckland Province and including Nelson and Marlborough) shows a decrease of 198, and Canterbury-West Coast district shows a decrease of 66, compared with the previous year, while Auckland and Otago districts show increases of 280 and 42 respectively. The increase in the Auckland District can be traced as having taken place in low-lying swampy areas already referred to, and Otago's increase is attributable to reactions as a result of the tuberculin test, and is confined to a few herds. The number of cattle (excluding calves) examined at freezing-works and abattoirs on slaughter was 321,039, of which 16,333, or 5·08 per cent., were found to be affected in varying degrees, a considerable number only very slightly. These figures show a decrease of 0·08 per cent. on last year's returns, and, although small, it is nevertheless satisfactory, following as it does on the somewhat larger decrease which was shown for the preceding year. In the case of swine a decrease of 0·35 per cent is disclosed, which is also a satisfactory feature. The number of swine examined was 418,316, of which 34,405, or 8·22 per cent., were found to be affected in varying degrees, and, as in the case of cattle, a considerable number only very slightly.

Reputed Phosphate Rocks.—Several samples of reputed local phosphate deposits were submitted to the Chemistry Section of the Department during the last official year, but none was found to be of any commercial value. A reported discovery of highly phosphatic limestone in the Piopio district (King-country) was fully investigated, samples being taken by the Director of the Geological Survey and analysed in the Chemical Laboratory. The deposits proved to be remarkably pure limestone, containing less than 0·1 per cent. of phosphate, but 98 to 99 per cent. carbonate of lime.

THE NEW FERTILIZERS ACT.

ITS MAIN POINTS AND INCIDENCE.

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LEGISLATION to control the sale of fertilizers in New Zealand was first promoted in 1892, when the Manure Adulteration Act was passed. This measure was superseded by the Fertilizers Act, 1904, afterwards consolidated in the Fertilizers Act, 1908, which, among other things, provided for the registration of vendors and gave greater powers of control to the administering Department.

In response to a widespread demand from farmers for more information as to the nature and quality of the fertilizers they were using, and to bring our legislation into line with that of other British dominions, the Fertilizers Act, 1927, was prepared, and passed by Parliament during the recently ended session. The new Act not only affords greater protection to the users of fertilizers—who in the last year spent over a million pounds sterling in the purchase of fertilizer materials—but also provides certain improved conditions for manufacturers and vendors.

BENEFITS TO THE FARMER.

Under the Act of 1908 the vendor was required to give the purchaser of 5 cwt. or more of any fertilizer a certificate stating the percentages of the fertilizer ingredients—nitrogen (soluble and insoluble in water), phosphoric acid (soluble and insoluble), and potash. This information was in many cases of very limited value to the farmer. He was told, for example, that his fertilizer contained 3 per cent. of insoluble nitrogen and 12 per cent. of insoluble phosphoric acid. But he did not know whether the nitrogen was in a form such as dried blood, quickly available to the plant, or in that of the less readily available meat-works tankage, or even in a form of nitrogenous waste matter (*e.g.*, hair or leather) that would take a very long time to decompose in the soil and become of use to the crop. In the case of phosphoric acid he was not told whether it was supplied as basic superphosphate, or as slower-acting ground rock phosphate, or in some other form.

Under the new Act the purchaser will receive with each lot of 5 cwt. or more a certificate showing not only the percentages of the fertilizer ingredients, but the forms in which they occur and the proportion of each component in the mixture. He will also know the nature and amount of any "filler" used. Here it may be pointed out that a filler or diluent (*i.e.*, a substance containing no nitrogen, phosphoric acid, or potash, mechanically incorporated in a fertilizer mixture) is not necessarily, nor even usually, to be regarded as an adulterant. Such substances have legitimate uses in certain mixtures, such as in improving their mechanical state for drilling and in standardizing the composition of the fertilizer. In the case of certain fertilizers, such as basic slag and ground rock phosphate, in which the fineness of grinding is important, the fineness will be shown on the vendor's certificate. The regulations under the Act will prescribe standards of fineness required in such fertilizers.

The invoice certificate has the effect of a warranty by the seller to the purchaser that the particulars contained in it are true within any limits of error prescribed in the regulations.

An important feature of the Act is the restriction of the use of the term "fertilizer" to substances accepted for registration as fertilizers under the Act. Any person offering for sale as a fertilizer any substance not registered as such is liable to prosecution.

Any purchaser desiring an official analysis of a fertilizer supplied in packages may give notice within twenty days (previously ten days) to an Inspector, who will attend and take a sample on payment of the fee of two guineas. The vendor or his agent is entitled to be present at the taking of the sample, and in the event of the analysis proving the accuracy of the invoice certificate the vendor may claim from the purchaser his reasonable expenses incurred in attending.

A facility not provided in the Act, but which may again be mentioned here, is that the Department of Agriculture will make without charge an unofficial analysis of any sample of fertilizer bought by a farmer, if accompanied by the vendor's invoice certificate for comparison with the analysis. Such samples should be of 1 lb. to 2 lb. in weight, taken from several bags, and should be addressed to the Chemist, Department of Agriculture, Dominion Laboratory, Wellington. On completion of the analysis the purchaser will be advised whether the composition of the fertilizer is in accordance with the invoice certificate.

THE ACT IN RELATION TO MANUFACTURER AND IMPORTER.

The manufacturer or importer is required to register his name and address, and to apply for registration of the brand of each fertilizer he proposes to sell. The application must be renewed in the month of June in each year. He will deposit a full description of each fertilizer as outlined above, and will receive a certificate of registration with respect to each brand. Previously the manufacturer had no protection of his brand under the Act, provided that no fertilizer sold under the same brand differed materially in composition. The new Act gives this protection to the owner of a registered brand. Registration of a brand remains in force until the end of June next following.

Provision is made for the sale of fertilizers in bulk, and for the sale, without registration, of "special mixtures" (to be so branded) of fertilizers in proportions according to the written instructions of the purchaser. In the case of such special mixtures the invoice certificate may show the required particulars separately in respect to each constituent of the mixture.

The registered particulars of a fertilizer will no longer show the "minimum percentages" of the ingredients, but will state the actual percentages within the limits of error allowed in the regulations. The statement of chemical ingredients required in the vendor's statement and invoice certificate has been simplified. Unit values and "equivalents" in tricalcic phosphate and in sulphate of potash have been eliminated, and the term "phosphoric acid" has been substituted for "phosphoric anhydride." The terms "nitrogen," "phosphoric acid," and "potash" must be expressed in words and not in symbols.

The vendor may, at his option, state the "citric solubility" of such fertilizers as basic slag.

Vendors may keep stocks of fertilizers in bulk, but must keep a record of the registered brands of such fertilizers so that the brand of any bulk lot can be readily ascertained.

Special provision is made for fertilizers imported on behalf of consumers but not offered for sale or exchange in the ordinary way. In such a case the person or firm acting as agents for the consumer is not required to register as a vendor, but must, within fourteen days after receiving the fertilizer, forward to the Chemist of the Department of Agriculture a sample of the fertilizer, and forward to the Director-General a statement containing the particulars (other than brand and name) required to be deposited by a manufacturer or importer. On distributing the fertilizer the agent must supply each consumer with a statement containing the particulars required to be set out in an invoice certificate. Similarly, if such a buyer's agent purchases fertilizers in New Zealand on behalf of consumers, he is required to supply to each consumer a copy of the invoice certificate received by him.

OBLIGATIONS OF THE RETAILER.

The retailer or selling agent who does not manufacture, import, or mix fertilizers is no longer required to deposit with his registration full particulars of the ingredients of fertilizers. He will register his name and address, and will deposit a statement showing, in respect to each fertilizer offered for sale, the brand and name of the fertilizer, and the name and address of the person or firm by whom the brand has been registered. He will, of course, supply the purchaser with an invoice certificate showing the full particulars of the fertilizer.

It is provided that a vendor who may be convicted of an offence under the Act in selling fertilizer at variance with the invoice certificate may, in any action against the previous vendor for breach of warranty, recover the amount of the penalty and costs on proving that he purchased the fertilizer in good faith and sold it in the same condition as he received it.

REGULATIONS.

The regulations to be gazetted under the new Act will prescribe, among other things, the limits of error allowed in the manufacturer's statement and invoice certificate, the methods of sampling and of analysis, and the standards of fineness of grinding of certain fertilizers.

The new Act comes into force on 1st June, 1928; until then the provisions of the Fertilizers Act, 1908, remain effective.

Soda Flavour in Butter.—The so-called "soda flavour" in butter was investigated by the Chemistry Section of the Department during the past year. The results obtained led to the conclusion that the objectionable flavour was due in many cases to the use of high-acid cream, rather than to the over-neutralization of cream of a lower degree of acidity.

RAPE-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926–27.

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In pursuance of the policy of testing the manures used in its experiments over a period of years, trials similar to those made in the two preceding seasons were again carried out by the Department of Agriculture in 1926–27, on the farms of Mr. J. Symes, Darfield, and Messrs. R. and J. Gunn, Racecourse Hill. The investigation chiefly affecting the method of application of superphosphate was also repeated, with certain modifications, on the farm of Mr. W. W. Mulholland, Darfield. The experiments are again designated "A" (Symes), "B" (Gunn), and "C" (Mulholland). The preceding two years' results were recorded in the *Journal* for November, 1925, and October, 1926, respectively.

Experiments A and B.

The treatments used on these experiments were as follows:—

(1) Superphosphate (44/46 per cent. tricalcic phosphate), 1 cwt. per acre.
(2) Ephos phosphate, 1 cwt. per acre.
(3) Super ½ cwt. and Ephos ½ cwt., 1 cwt. per acre.
(4) Super 1 cwt. and dried blood 1 cwt., 2 cwt. per acre.
(5) Superphosphate, 2 cwt. per acre.
(6) Super 1 cwt. and Ephos 1 cwt., 2 cwt. per acre.

Six replications of the above were sown. The seed was sown in 7 in. rows (*i.e.*, through every coulter of the drill). Dates sown: Experiment A, 23rd November; experiment B, 10th November, 1926. Seeding for both experiments, 2½ lb. per acre (the same as in the preceding year, which was recorded as 3 lb. by mistake). History of paddocks: Experiment A, 4 years in grass prior to trial; experiment B, 5 years in grass before test.

EFFECT OF MANURES ON GERMINATION.

Table 1 shows the number of plants occurring in one row 10 ft. in length. The germination under each treatment is compared with that on the 1 cwt. of super plots.

Comments on Table 1.

All treatments in Experiment A have given more than twice the germination of the same treatments in Experiment B, although both areas were sown at the same rate per acre. The difference is due to the fact that Experiment B, sown on 10th November, experienced a severe thunderstorm two days later and further heavy rain in the following week, with the result that the surface of the ground became badly poached and the plants had difficulty in getting through. Experiment A, sown on 23rd November, met with ideal conditions. In both experiments the only treatments which show a significant depression in germination are the super-and-blood mixture and the super 2 cwt. In neither case is this anything approaching the bad effect of these treatments in the preceding season on Mr. Symes's

Table 1.—Effect of Manures on Germination in Experiments A and B.

Treatment per Acre.	Experiment A. Counts taken 43 Days after Sowing.			Experiment B. Counts taken 42 Days after Sowing.		
	Number of Plants per 10 ft. (Mean of 78 Counts).	Difference from Super 1 cwt. Plots.	Difference, Significant (S.) or Non-significant (N.S.).	Number of Plants per 10 ft. (Mean of 66 Counts).	Difference from Super 1 cwt. Plots.	Difference, Significant (S.) or Non-significant (N.S.).
Super 1 cwt.	28·4	..	..	13·5	..	..
Ephos 1 cwt.	27·2	−1·2	N.S.	13·6	+0·1	N.S.
Super ½ cwt. and Ephos ½ cwt.	29·3	+0·9	N.S.	12·8	−0·7	N.S.
Super 1 cwt. and blood 1 cwt.	26·7	−1·7	S.	12·0	−1·5	S.
Super 2 cwt.	25·0	−3·4	S.	11·7	−1·8	S.
Super 1 cwt. and Ephos 1 cwt.	27·9	−0·5	N.S.	13·2	−0·3	N.S.

NOTE.—A difference is regarded as "significant" where the chances are greater than 30 to 1 in its favour.

farm, where the blood mixture germinated only 54 per cent. and the super 2 cwt. 61 per cent. compared with super 1 cwt. as 100 per cent.

In the 1926–27 season there was always an ample supply of moisture during the early growing-period, and the plasmolysing (commonly called "burning") effect of the heavier dressing of super was much reduced. The fact that under conditions of ample moisture blood has not been so harmful on germination points to the fact that this substance, too, *may* cause plasmolysis, possibly by rapid bacterial conversion into nitrates.

FIG. 1. RAPE EXPERIMENT A (SYMES'S FARM).
From left: (1) No manure; (2) super 1 cwt.; (3) Ephos 1 cwt. Photo taken on 26th January, 1927.

Observations during Growth.

Experiment A: On 5th January, forty-three days after sowing, the plots having the heavier dressing of super plus Ephos at 2 cwt., and super plus blood, were the best grown. The super at 1 cwt. and super plus Ephos at 1 cwt. were equally good, and better than super 2 cwt. and Ephos, which was an easy last. At this stage the super 2 cwt. plots had an unhealthy appearance, and in spite of good conditions were evidently suffering from too great a concentration of soluble material in close proximity to the young plants. The plots recovered later. Fig. 1 shows the appearance of some of the plots on 26th January last. At the time of cutting the Ephos plots were slightly riper than the remainder, and, if anything, the more heavily manured plots were least ripe.

YIELDS.

The crops were cut and weighed under the methods adopted by the Fields Division in Canterbury, as described in the *Journal* for July, 1926. In the 1925–26 season cutting was done at two different periods on account of slight differences in ripening, and two sets of results were obtained. Relatively the results were much the same, and there seems no occasion to weigh at different periods. The yields for both experiments are shown in the following table:—

Table 2.—Yield Results on Experiments A and B.

Area of individual plot, $\frac{1}{133}$ acre.

Treatments compared, A with B.	Experiment A: Cut 4th February, 1927, 10 weeks 3 days after Sowing.				Experiment B: Cut 26th January, 1927, 11 weeks 1 day after Sowing.			
	Number of Paired Plots.	Tons per Acre. Yield.	Tons per Acre. Difference.	Difference, Significant (S.) or Non-significant (N.S.).	Number of Paired Plots.	Tons per Acre. Yield.	Tons per Acre. Difference.	Difference, Significant (S.) or Non-significant (N.S.).
A. Super 1 cwt. ..	12	9·38	0·92	S.	10	8·17	2·5	S.
B. Ephos 1 cwt. ..		8·46	..	..		5·67	..	..
A. Super 1 cwt. ..	18	9·12	0·12	N.S.	23	7·73	..	..
B. Super and Ephos 1 cwt.		9·00	..	..		7·93	0·2	N.S.
A. Super 1 cwt. ..	12	9·26	..	..	24	7·87	..	..
B. Super and blood 2 cwt.		10·12	0·86	S.		8·53	0·66	S.
A. Super 1 cwt. ..	18	9·11	..	..	24	7·87	..	..
B. Super 2 cwt. ..		9·43	0·32	N.S.		8·29	0·42	N.S.
A. Super 1 cwt. ..	18	9·12	..	..	24	7·87	..	..
B. Super and Ephos 2 cwt.		9·84	0·72	S.		8·48	0·61	S.
A. Super 2 cwt. ..	17	9·42	..	..	24	8·29	..	..
B. Super and Ephos 2 cwt.		9·84	0·42	S.		8·48	0·19	N.S.

NOTE.—The difference is placed opposite the higher-yielding plot in each case.

Comments on Table 2.

(1) Super at 1 cwt. shows a marked superiority in yield over Ephos at 1 cwt. per acre in both experiments.

(2) Super and Ephos at 1 cwt. per acre does not differ significantly from 1 cwt. of super in yield.

(3) The addition of 1 cwt. of dried blood to the super has caused significant increases in yield in both cases.

(4) 2 cwt. of super shows non-significant increases in both experiments. In view of the certainty attached to the increases from super and Ephos at 2 cwt. (see next comparison) it is highly probable that the benefit from the 2 cwt. of super is real, though small.

(5) Super and Ephos at 2 cwt. per acre shows a considerable increase over the super at 1 cwt. on both farms.

(6) A direct comparison between super at 2 cwt. and super plus Ephos at 2 cwt. reveals a definite increase in favour of the latter in Experiment A, while that in Experiment B is uncertain.

SUMMARY OF COMPARISONS BETWEEN SUPER AND EPHOS: THREE SEASONS' RESULTS.

Table 3 is compiled from the results of the experiments conducted in the Darfield-Racecourse Hill district during the past three years.

Comments on Table 3.

So far as the experiments already conducted are concerned it can be taken as definitely established that super at 1 cwt. per acre is a better form of phosphate for rape than Ephos sown at the same rate. In all the trials enumerated in the table the rape was sown in 7 in. drills, except the first mentioned. This was in 14 in. drills, and in the light of more recent knowledge on the effect of manures on germination it seems probable that the quantity of 1½ cwt. of super applied in that season may have so affected germination as to thin the plants considerably below the number on the Ephos plots. No further work with straight-out Ephos as a rape-manure will be done in Malvern County. The other treatment mentioned elsewhere in this article will be given further trial.

Table 3.—Super and Ephos compared: Three Seasons' Results.

Season.	Yields in Tons per Acre.		Difference in Favour of Super (+) or Ephos (−).	Farm.
	Super* 1 cwt.	Ephos 1 cwt.		
1924–25 ..	5·01	5·39	−0·38	W. W. Mulholland, Darfield.
,, ..	7·05	4·78	+2·27	R. S. Gunn, Racecourse Hill.
,, ..	9·21	9·08	*+0·13*‡	J. Symes, Darfield.
1925–26† ..	4·22	3·78	+0·44	,, ,,
,, † ..	5·31	4·42	+0·89	R. S. Gunn, Racecourse Hill.
1926–27 ..	9·38	8·46	+0·92	J. Symes, Darfield.
,, ..	8·17	5·67	+2·50	R. and J. Gunn, Racecourse Hill.

Average increase of super over Ephos, 1·08 tons.

* Both manures were sown at 1½ cwt. per acre in the 1924–25 season.

† The yields in 1925–26 season are the averages of weighings taken at two different periods of growth (see *Journal*, October, 1926, pages 254 and 255).

‡ All differences are highly significant except that shown in italics.

Experiment C.

Date sown, 9th November, 1926; seeding, 1¼ lb. per acre in 14 in. drills. History of paddock: 1925–26 and 1924–25, grass: 1923–24, oats; 1922–23, wheat.

As in the previous season, the object of the experiment was to test the effect of method of application of different quantities of (mainly) super on yield and germination. Some modifications of the previous year's trial were made. The treatments used in 1926–27 (with the seeding in 14 in. drills) were as follows:—

(1) Super ½ cwt. per acre; manure in 14 in. drills.
(2) Super 1 cwt. per acre; manure in 7 in. drills.
(3) Super 1 cwt. per acre; manure in 14 in. drills.
(4) Super 2 cwt. per acre; manure in 7 in. drills.
(5) Super 2 cwt. per acre; manure in 14 in. drills.
(6) Super 1 cwt. and dried blood 1 cwt. per acre; manure in 7 in. drills.
(7) Super 1 cwt. and dried blood 1 cwt. per acre; manure in 14 in. drills.

Seven replications of these treatments were sown, the strips being about 6 chains in length.

NITRATE OF SODA.

From the preceding season's experiment it was obvious that the sowing of a highly soluble nitrogenous manure (sulphate of ammonia in that case) in contact with the seed was likely to be attended by very harmful effects on germination. The top-dressing of nitrate of soda was therefore decided upon. It was applied at the rate of 85 lb per acre, this being the amount calculated to equal the blood in nitrogen content. Application was made by drilling in the nitrate of soda in ½-chain-wide strips at right angles to the rows of rape. The nitrate-treated strips alternated with similarly dimensioned strips, which, to ensure uniform cultivation on treated and untreated, were drilled only. Fig. 2 shows a portion of the area.

FIG. 2. RAPE EXPERIMENT C (MULHOLLAND'S FARM).

Immediately behind notice-board is an unsown strip; the other comparatively bare-looking strip is a no-manure plot. Pegs between unsown and no-manure strips mark ½-chain-wide sections of nitrate and no-nitrate.

The nitrate was applied forty-four days after sowing. A fortnight later the effect of the dressing was evident by the treated plots showing a deeper colour, characteristic of the effect of the treatment. The crop was weighed on 27th January, eleven weeks and three days after sowing. No marked differences (apart from the nitrate-treatment strips) in the appearance of the plots could be seen, except that the super and blood in 14 in. drills was darker in colour than the remainder. Table 4 presents a comparison between the different quantities and methods of application. The germination is also shown in this table.

Table 4.—Yield Results of Experiment C.

Area of individual weighed plot, $\frac{1}{888}$ acre.

Treatments compared, A with B.	Yields and Difference in Yields.					Effect of Manures on Germination*; 56 Counts each Treatment.		
	Spacing of Manured Rows.	Number of Paired Plots.	Tons per Acre. Yield.	Tons per Acre. Difference.	Difference, Significant (S.) or Non-significant (N.S.).	Plants per 10 ft.	Difference in Number of Plants per 10 ft.	Difference, Significant (S.) or Non-significant (N.S.).
	Inches.							
A. Super ½ cwt. ..	14	42	3·58	..	..	24·2	..	N.S.
B. Super 1 cwt. ..	7		3·81	0·23	S.	24·6	..	..
A. Super 1 cwt. ..	14	42	3·93	..	..	21·8	..	N.S.
B. Super 2 cwt. ..	7		4·11	0·18	N.S.	22·0	..	..
A. Super 1 cwt. ..	14	41	3·90	0·13	N.S.	21·8	..	..
B. Super 1 cwt. ..	7		3·77	..	..	24·6	2·8	S.
A. Super 1 cwt. ..	14	42	3·93	..	..	21·8	7·3	S.
B. Super 2 cwt. ..	14		3·96	0·03	N.S.	14·5	..	..
A. Super 1 cwt. ..	14	21	3·52	..	..	21·8	7·3	S.
B. Super 1 cwt. and blood 1 cwt.	14		3·73	0·21	N.S.	14·5	..	..
A. Super 1 cwt. ..	7	21	3·48	..	..	24·6	3·0	S.
B. Super 1 cwt. and blood 1 cwt.	7		4·02	0·52	S.	21·6	..	..

* Germination counts taken 22nd December, 43 days after sowing.

NOTE.—In the first four comparisons above the line the yields are computed from plots half of which received a dressing of nitrate of soda, the other half having no nitrate in each case. In the two comparisons below the line the treatment shown had no nitrate of soda.

Comments on Table 4.

(1) Super ½ cwt. in 14 in. *versus* super 1 cwt. in 7 in. drills: The extra ½ cwt. of manure between the seed-rows has caused a slight significant increase in yield to the extent of about ¼ ton per acre. The germination is practically the same on both treatments. This is as it should be, considering the same quantity of manure is sown per seed-row in each case.

(2) Super 1 cwt. in 14 in. *versus* super 2 cwt. in 7 in. drills: The slight increase due to the extra 1 cwt. between the seed-rows is not significant. The germinations do not differ significantly, although both are significantly lower than those in the preceding comparison.

(3) Super 1 cwt. in 14 in. and super 1 cwt. in 7 in. drills do not show a certain difference in yield. The germination has been reduced on the former by 2·8 plants per 10 ft.

(4) Super 1 cwt. in 14 in. and super 2 cwt. in 14 in. drills are practically the same in yield. The heavier quantity of manure has had a serious effect on germination, reducing it to 66 per cent. of the 1 cwt. quantity.

(5) The addition of 1 cwt. of blood to the super in 14 in. drills has not yielded a significant increase. The germination has been reduced by the blood to the same extent as in the case of the extra 1 cwt. of super (paragraph 4 above).

(6) The removal of half the blood from direct contact with the seed has allowed a better germination than where the whole was sown in 14 in. drills. The increase of just over ½ ton is highly significant.

(7) The standard method of applying 1 cwt. of super with the seed in 14 in. drills has given practically as good results as any other quantity or method of application of super in the experiment.

Table 5.—Results of Experiment C: Phosphate compared with Phosphate plus Nitrate of Soda.

Treatment.	Spacing of Manured Rows.	Number of Paired Plots.	Tons per Acre.		
			Yield of Treatment shown in Column 1.	Yield of Treatment plus Nitrate of Soda.	Difference in Favour of Nitrate of Soda Addition.
	Inches.				
Super ½ cwt.	14	35	3·25	3·85	0·60
Super 1 cwt.	7	38	3·48	4·42	0·94
Super 1 cwt.	14	35	3·53	4·33	0·80
Super 2 cwt.	7	35	3·76	4·42	0·66
Super 2 cwt.	14	35	3·54	4·31	0·77

NOTE.—All differences shown in last column are highly significant.

Table 6.—Results of Experiment C. Phosphate plus Blood compared with Phosphate plus Nitrate of Soda.

Treatments compared, A with B.	Spacing of Manured Rows.	Number of Paired Plots.	Tons per Acre.		Difference, Significant (S.) or Non-significant (N.S.).
			Yield.	Difference.	
	Inches.				
A. Super 1 cwt. and blood 1 cwt...	7	33	3·99	..	..
B. Super 1 cwt. and nitrate of soda broadcast	7		4·46	0·47	S.
A. Super 1 cwt. and blood 1 cwt...	14	35	3·71	..	..
B. Super 1 cwt. and nitrate of soda broadcast	14		4·34	0·63	S.

Comments on Tables 5 and 6.

In Table 5 each of the straight phosphates is compared with the same phosphate plus nitrate of soda. All the increases are highly significant. Table 6 sets out the relative merits of blood and nitrate

of soda. The nitrate has the advantage in both cases, although it must be remembered that the germinations were different.

Messrs. Mulholland, Gunn, and Symes again gave their keen support to the work, and thanks are due to them. The Fields Division's staff at Christchurch ably assisted in much of the work.

GOOD WATER FOR COUNTRY HOUSEHOLDS.

New Zealand Department of Health.

THE resident in a borough is only very occasionally required to give any thought to the household water-supply, as the problem of securing and supplying a good water has usually been taken over by the local authority. The country resident, however, is in a different position, as he has to face and solve his own difficulties with regard to his water-supply. In many cases dependence has to be placed on tanks; in other cases wells have to be sunk; in still others a natural spring may be used; and some few may tap a natural watercourse or stream. In each of these different cases different difficulties arise; different precautions should be taken; and it is now proposed very briefly to discuss these questions.

Tanks.

The collection of rain-water is perhaps the most common method of securing a water-supply for a country household. The collecting surface is usually the roof. It is rare in the country to use specially prepared areas to collect rain-water. The amount of rain-water collected depends, of course, on two factors: (1) The area of the collecting surface, and (2) the amount of rainfall. Roofs of houses are usually polluted with dust, droppings of birds, leaves of trees, &c., and it is therefore advisable to allow the first of the rain to run to waste. This washes the roof and so ensures a cleaner and purer water. There are various simple contrivances, called "rain-water separators," which allow the first part of a fall to run to waste and then automatically divert the remainder of the rainfall into the collecting-tank.

It is, of course, necessary to see that all spoutings and gutters are kept in a cleanly state. The best storage tank is one of concrete with a smooth inner surface of cement plaster. Rain-water readily attacks metal surfaces, and therefore iron tanks are not so acceptable. In addition, no lead pipes should be used in connection with a water system depending on rainfall, as rain-water can readily dissolve lead. Owing to the fact that it is very soft, rain-water is very useful for laundry and cooking purposes. If the ordinary household supply is "hard," it is an economy to save rain-water for use in the laundry. Rain-water in the country is usually very pure, but this statement does not hold with regard to rain-water collected in towns, where the atmospheric pollution is much greater. As the rain descends it washes the air and collects the impurities such as dust, smoke, and bacteria that may be floating in the atmosphere.

Wells.

Wells are technically known as "shallow" or "deep" wells. With the latter may be included what are known as "artesian" wells. Although depth may have some bearing upon this classification, the question of the ground strata from and through which the water is drawn is of more importance. With the exception of such as flows off the surface into rivers, streams, and lakes, all water deposited on the earth's surface by rainfall which is not evaporated sinks into the ground, and, subject to the varying permeability of the soil and the

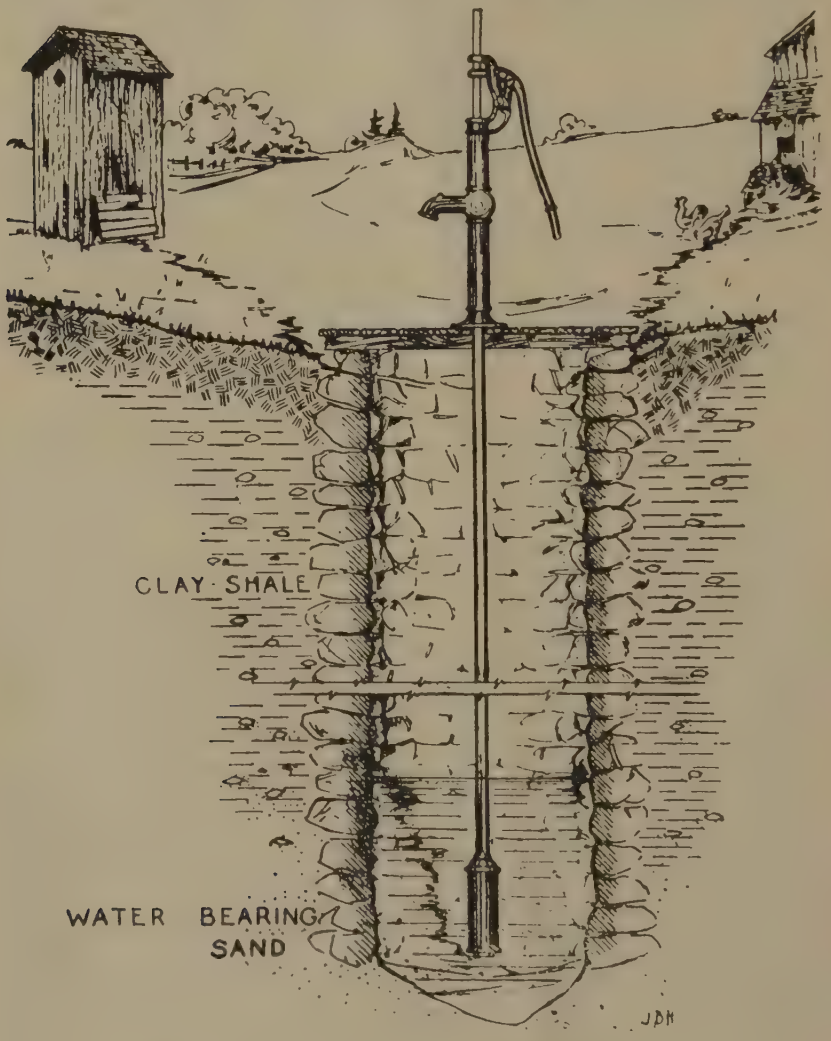

FIG 1. BADLY SITUATED AND CONSTRUCTED WELL.

Water from such a source is liable to pollution, and is therefore unsafe for drinking-purposes.

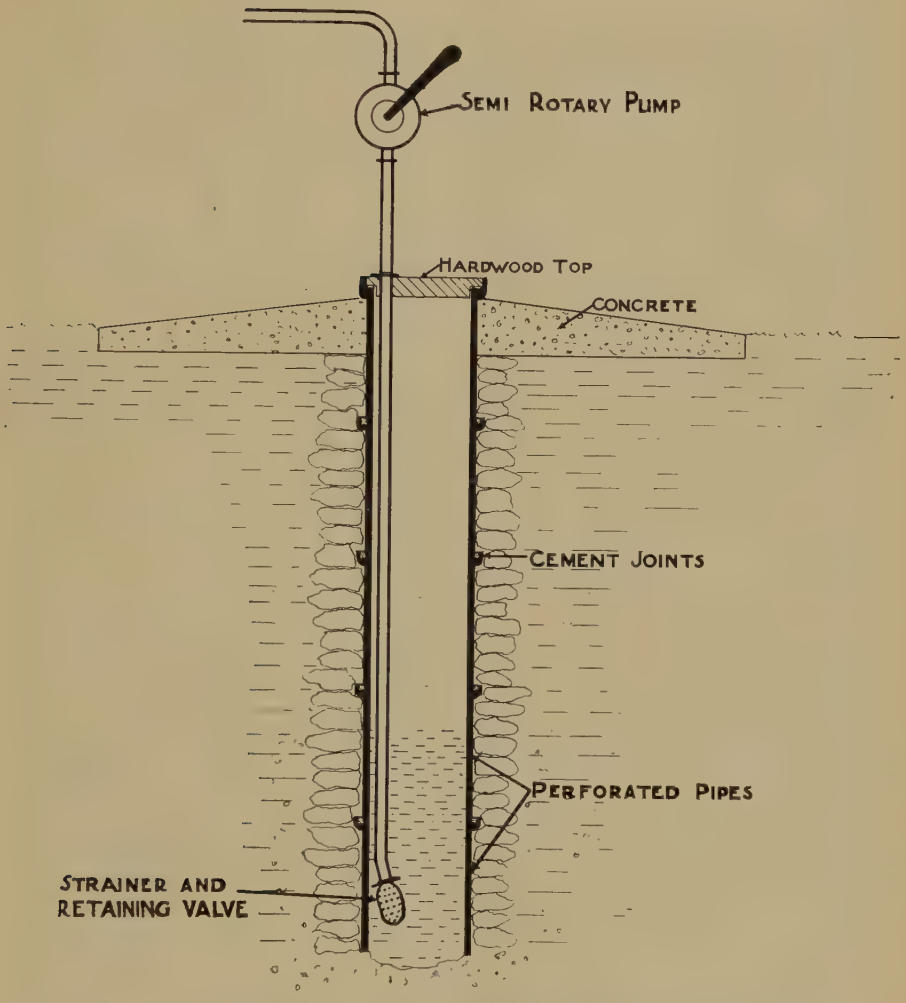

FIG. 2. A BETTER TYPE OF WELL, AFFORDING PROTECTION FROM POLLUTION.

subsoil strata, finds its way to varying depths in the earth and obeys the natural law of gravity by seeking a lower level. There are thus what may be termed "underground streams," the depth of which is determined by the perviousness or imperviousness of the subsoil strata they have met in their passage through the earth's surface. Water which has found its way through the easily permeable strata of the subsoil but has been arrested in its downward progress by an impervious stratum is drawn upon by what are termed "shallow wells." Such water, from its liability to pollution by the organic matter which it may have taken up from the ground upon which it has fallen or through which it has percolated, is of doubtful quality for domestic purposes, and may even be dangerous to health, if such pollution is excretal in origin.

Shallow-well water can therefore never be advocated as a "safe" supply, but where its use is unavoidable, owing to the absence of any better supply, steps must be taken to obviate its pollution, and particularly its pollution by organic matter of an excretal nature. No such well should be driven or sunk at a less distance than 150 ft. from any privy, urinal, sewage-tank, or cesspool, pigsty, stable, or cow-bail. Neither should it be sunk in heavily manured country, particularly land polluted with nightsoil. All nightsoil should be buried well away from its vicinity, and house-drainage should be carried in a direction away from such well. Sanitary conveniences, farm buildings, stables, &c., should be situated where the subsoil water is flowing away from the well.

Protection from surface washings should be afforded by covering the head of the well with a dome-shaped cover of cement concrete of somewhat greater area than the well-head, provided with openings for the pipe main and access to clean the well. The sides from top to bottom should be protected by a lining of impervious material such as glazed earthenware with cement joints, or cement concrete, or brick in mortar with a backing of stiff clay. If any reasonable suspicion of the water is entertained it should be boiled before use for potable purposes.

Shallow-well waters are usually fairly soft and of good use economically for laundry purposes. On the other hand, deep-well waters are usually fairly hard, well aerated, and pure, owing to their having taken up much mineral matter into solution during the lengthier percolation, with its resultant greater filtration, they have undergone. It is usually only necessary to protect such supplies from actual pollution at the source of supply, and to ensure that from the surface down to the impervious stratum, from the under-side of which they are drawn, no surface or shallow-well water gains access. This may be effected by ensuring tight joints in any pipes through which the water is drawn or flows by hydrostatic pressure to the surface in pipe wells, and by lining the well down to the impervious stratum as was previously set out in dealing with the shallow well.

Springs.

Where the water-supply is dependent on natural springs the same precautions in regard to prevention of pollution should be taken as in the case of wells. In addition the area round the spring should be securely fenced off, so as to prevent the access of cattle and other stock. The overflow from the spring should be piped away a considerable distance, so that the surrounding ground is kept as dry as possible. In any case where a spring is used for a water-supply an adequate chemical analysis should be made before the water is used for household purposes. Many springs which supply a clear, sparkling water show evidence on examination of serious and recent pollution.

Control of Chafers.—Attempts are being made by the Department's Biological Laboratory to locate certain species of parasites of North American Scarabaeidae that might be of value in the control of New Zealand chafers.

TOMATO-CULTURE IN ENGLAND.

THE CHESHUNT RESEARCH STATION AND ITS WORK.

Report by T. Rigg, M.Sc., M.A., F.I.C., Cawthron Institute, to the New Zealand Council of Scientific and Industrial Research.*

The Cheshunt Tomato Research Station is maintained partly from contributions of the tomato-growers in the Lea Valley (Hertfordshire), and partly from grants supplied by the Ministry of Agriculture. The following branches of research in connection with tomato-culture are maintained: (1) Cultural, (2) Chemical, (3) Mycological, (4) Entomological. Dr. W. Bewley is in charge of the station, and has a staff of some twenty workers. Close contact is maintained between the station and the growers by means of public lectures, visitors' days, &c. Free advice is given to all contributing tomato-growers.

Commercial Tomato-culture in the Lea Valley.

In the Lea Valley there are some 1,000 acres of tomatoes under glass. In many respects the conditions of culture are similar to those ruling in the Nelson district of New Zealand. Steam heat is used in the early part of the season, and certain minor differences in construction of houses exist. The English tomato-house is generally higher than the New Zealand house. Ventilation is secured most frequently from ventilators along the ridge-pole, which can be operated from one end of the house. In addition, ventilation at the end of the house is being recommended with a view to the better control of mildew.

The English tomato-grower plants 17,000 tomato-plants to the acre, against the Nelson grower's 12,000 plants. In the Lea Valley the plants are 12 in. apart in the rows, while the rows themselves vary in width from 18 in. to 2 ft.

The English tomato-grower floods his house at the conclusion of the picking season in the autumn. In view of what will be said later in connection with the incidence of "black-stripe," and the possible harmful effects of high concentrations of soluble salts in the top soil, such a practice has much to recommend it. It also ensures that at the commencement of the tomato season the subsoil is thoroughly damp. In our Nelson district there is good reason to suspect that not only does a high concentration of soluble salts operate detrimentally to crop-production, but also that the subsoil at the commencement of the season is not sufficiently damp to give the best results.

It is the custom to use 30 to 80 tons of stable manure per acre in the early winter treatment of the land under glass. A dressing of 2 tons of caustic lime per acre is invariably given. The lime is worked into the soil, and an application of 2 tons of phosphate and 1 ton of sulphate of potash is given as a base treatment. The top-dressing mixture, containing soluble phosphates, sulphate of potash, and soluble nitrogenous manure, is given every fourteen days, commencing when

* Mr. Rigg visited the Cheshunt Station when in England in connection with the recent Imperial Agricultural Research Conference.

the plants are about 2 ft. 6 in. high. Beyond the nitrogen contained in the stable manure it is not the custom to apply soluble nitrogen in the base treatment of the houses.

The following varieties are the most important in tomato-culture of the Lea Valley: Ailsa Craig, Manx Marvel, Stirling Castle, Kondine. In the best houses yields of over 50 tons per house-acre are obtained. This yield compares favourably with the yield obtained by the best growers in the Nelson district.

The pruning of laterals in the English tomato-houses is performed in the case of the best growers by means of a sharp knife. The use of a knife in preference to the use of a thumb-nail undoubtedly diminishes the risk of carrying infection from plant to plant; moreover, disease is not so likely to obtain entry where the knife has been used. Considerable care is taken in the packing of the tomatoes; small boxes containing 12 lb. are used for this purpose.

Experimental Work at Cheshunt.

SOIL-STERILIZATION.

Since the inception of the Cheshunt Station many experiments have been conducted on the sterilization of the soil in tomato-houses. The best results have always been obtained, as in our Nelson district, by the use of steam. In the past the "tray" and the "gridiron" methods have been used for steaming the soil. More recently Dr. Bewley has recommended the use of the "steam-fork," which has proved so successful in Nelson tomato-houses. As might be expected in view of the lower labour costs and lower price of coal in England, the expense in connection with the steam sterilization of Lea Valley tomato-houses is much smaller than that ruling in New Zealand. Dr. Bewley stated that an acre of glasshouse soil could be treated at the cost of £120.

Various experiments have been tried in connection with the sterilization of tomato soil by the means of various chemicals. In certain cases good results have been obtained by the use of cresylic acid and formalin. The chemicals, however, have not proved so reliable as steam treatment. Provided formalin can be obtained at a reasonable price, Dr. Bewley thinks that this chemical is likely to give more consistent results than those of others.

MANURIAL EXPERIMENTS.

Experiments in connection with the manuring of tomatoes have been in progress since the establishment of this research station. The following points seem to emerge as a result of several years' trial: (1) The preliminary treatment of the glasshouses in the autumn with 15 tons of stable manure per acre has given as high yields as those obtained by the use of 30, 60, and 90 tons. (2) Of the three common plant-foods required by tomato-plants, potash and nitrogen are used by the plant in much larger quantities than is the case with phosphate. A liberal supply of both potash and nitrogen has been shown to be necessary in order to secure high quality of tomatoes. The deficiency of these two plant-foods invariably results in an increase in the amount of blotchy fruit. A liberal supply of potash has also been shown to be of great value in controlling black-stripe. (3) Recent experiments

at the research station have shown the great value of green manures when used on land somewhat deficient in organic matter. Grass clippings have proved extremely beneficial in raising crop-production. Dr. Bewley was intensely interested in the green-manuring system of the Nelson tomato-growers, and the experiments conducted by the Cawthron Institute on the value of mustard, turnips, and rape as green manures.

Analyses of tomato fruits and plants, as well as manuring experiments, reveal the very low utilization of phosphate by tomato-plants. It seems very probable that much larger dressings of phosphates are used by tomato-growers throughout the world than are necessary.

Although considerable work has been done by the Cheshunt Station in determining the quantities of various plant-foods which are required for the average glasshouse in the Lea Valley, it has not been possible to make any recommendation which can be considered as final. Fundamental knowledge concerning the physiology of the tomato-plant, and concerning the effect of individual plant-foods on vegetative development, fruit-production, and disease-resistance, is urgently required, in order that the whole question of manuring may be rightly understood.

CARBON-DIOXIDE INVESTIGATIONS.

One of the more interesting investigations of the research station is that connected with the addition of carbon dioxide to the normal atmosphere surrounding the tomato-plants. During the last three years an increase in crop of 16 to 30 per cent. has been obtained by maintaining a concentration of carbon dioxide equal to 0·6 per cent. Formerly the carbon dioxide was produced by the action of sulphuric acid on sodium bicarbonate, but recently the practice has been adopted of burning a special type of fuel in a small Cardyox stove. The stove is lit two hours in the morning and two hours in the afternoon. The fuel is said to burn with the liberation solely of carbon dioxide. The Cardyox stove is a very simple contrivance, which undoubtedly could be purchased at small expense.

BLACK-STRIPE.

As is well known in scientific circles, Dr. Bewley and his colleagues have done considerable work on the disease known as black-stripe. Some time ago he published a paper in which the disease was attributed to the *Bacillus lathyri*. It was shown that inoculation of tomato-plants with pure cultures of this bacillus produced the characteristic brown streak associated with black-stripe. The characteristic symptoms of plants suffering from black-stripe are distinct from those of mosaic-infected plants. He showed me some plants infected with mosaic disease. These plants showed mottling of the leaves, but did not have the brown blaze on the stem which is associated with black-stripe. In the Nelson district tomato-growers commonly hold that a very similar mottling is the forerunner of black-stripe disease.

During the last season an instance of what may be termed "physiological stripe" has occurred in one of the Lea Valley tomato-houses. In this house the tomato-grower changed his soil for loam

obtained at a depth of 3 ft. The house was then manured in the usual way. At a very early stage, after planting, an abnormal condition of the plants was noticed. Pot experiments were instituted at the research station on this glasshouse soil. It was found that the plants developed a brown blaze on the stem very similar to that produced by definite inoculation with *Bacillus lathyri*. This physiological stripe could not be transmitted from plant to plant if such plants were grown on other soil. The bad effects on plant-growth of this particular soil were greatly reduced, or indeed eliminated, by prolonged washing of the soil. It suggests, therefore, that the physiological stripe results from the presence in the soil of some toxic compound. The discovery of this physiological stripe throws new light on the incidence of what we call black-stripe, and obviously much work will be required to elucidate the whole problem. It seems quite probable that in certain Nelson tomato-houses the physiological stripe may operate in addition to the true bacterial stripe.

Dr. Bewley stated that in the treatment of black-stripe they had recommended in the past the initial use of 10 cwt. of sulphate of potash per acre in the base manure. If the plants, when they had reached a height of 2 ft., showed the slightest tendency to black-stripe infection a dressing of 10 cwt. of sulphate of potash per acre was immediately applied. This dose was repeated in fourteen days' time. Quite frequently a dose of nitrogenous manure was necessary in order to encourage vegetative growth following the second application of sulphate of potash.

VARIETY TESTS.

The research station has made many tests of both English and American varieties. Among the American varieties Norduke has been grown, but the results obtained with it have been even more disappointing from the point of view of yield than those obtained from this variety in the experiments of the Cawthron Institute. Both Ailsa Craig and Manx Marvel have given very excellent results in the trials conducted by the Cheshunt Station. The Ailsa Craig tomato is noticeably bigger than that of this variety tested in the Nelson district. The station has produced a new variety as a result of crossing Ailsa Craig, and this promises exceedingly well. Dr. Bewley has very kindly offered seed of his more important varieties, in addition to his cross of Ailsa Craig, for testing in New Zealand.

INVESTIGATIONS ON MILDEW (CLADOSPORIUM FULVUM).

Considerable work has been done in testing the resistance of various varieties of tomatoes to mildew. Stirling Castle, Up-to-Date, and Norduke have proved the most resistant. So far none has been found immune.

CONTROL OF RED SPIDER AND WHITE FLY.

Many experiments have been conducted in regard to the control of red spider and white fly (*Trialeurodes vaporariorum*) in tomato-houses. Naphthalene fumigation has been shown to be very successful in the control of red spider. A parasite (a chalcid wasp) has been introduced to control the white fly.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS IN 1926–27.

J. W. DEEM, Instructor in Agriculture, and Chairman, Stratford Demonstration Farm Society.

THE season of 1926–27 opened well in the Stratford district, and there was every promise of a good spring. However, about the middle of September the weather broke, and from then on to the middle of December conditions were very bad, rain falling almost every day. This delayed all farm operations and necessitated the sowing of crops in land that was not properly prepared, with the result that some of the crops were lighter than usual. The exceptionally bad spring was also reflected in the milk returns, the continuous cold rain during October and November severely checking pasture-growth. By the end of October the farm was badly poached by tramping, and during November advantage had to be taken of an ensilage stack that had been left over from the previous year to tide the stock over the period of shortage. This again emphasizes the value of a reserve stack of ensilage. In this case we were able to keep the herd going until the feed came away again about the middle of December, after which there was plenty. Had the herd gone back during the month of November it would have been impossible to get the yield up again during December and January, no matter how good the feed.

PASTURES.

A further area of 18 acres was put down to permanent pasture during the year. The farm is now in its tenth year, and so far it has not been necessary to renew any permanent pastures sown during that period. The imported wild white and genuine colonial white clovers continue to show their supremacy over ordinary imported white. On the new areas sown down during the year some further white clover tests have been included, also some tests between various strains of red clover, including Cornish Marl and Montgomeryshire Late-cut. The latter is giving very fine results at the Marton Experimental Area, and there are indications that it is going to do well at Stratford.

Top-dressing Trials.

The Rhenania phosphate mentioned in last year's notes (*Journal*, October, 1926) did not give quite as good results as the basic slag or super on adjoining areas, and there does not appear to be any good reason to continue with this fertilizer. In this year's scheme of top-dressing Seychelles Island phosphate and Sulfurophosphate are being tested. The potash experiments have been extended, and now include kainit, 30 per cent. potash, sulphate of potash, and muriate of potash. So far there is no definite evidence that the addition of any of these potassic fertilizers to the usual phosphatic manures has been advantageous. They are being applied at the following rate per acre per year: Kainit, 2 cwt.; 30 per cent. potash, 1 cwt.; sulphate and muriate of potash, ½ cwt. each. Two of the areas have now had kainit for four years in succession, but still fail to show any definite response, nor are

the pastures more palatable to stock. We consider that the money spent on potash would give a much greater return if spent on additional phosphates. Basic slag is still our best fertilizer, but areas treated with basic super, super and lime, super, and super plus Nauru rock phosphate are very satisfactory, while super following slag is giving very good results.

ROOT CROPS.

As mentioned in the introductory paragraph, the spring was a very difficult one for sowing root crops, and many of these were below the average.

Mangolds.—Sixteen varieties of mangolds were grown, a number being Danish and new English varieties or strains. As in previous years, Prizewinner gave the best results in the main crops, being closely followed by Red Intermediate; Sharp's Mammoth Long Red and Wiboltt's Dana Ovid were the best of the others. Our standard manure for mangolds is now three parts super and one part each of bonemeal and Nauru phosphate, at 6 cwt. per acre, plus 3 cwt. kainit or common salt. A carefully conducted experiment has been carried out for the past three years to determine the value of salt, kainit, and sulphate of potash respectively used in addition to phosphatic manures. Table 1 gives the result, "mixture A" being the standard manure specified above.

Table 1.

Manure.	1926.	1927.	Average of Two Years.
	Tons cwt.	Tons cwt.	Tons cwt.
Mixture A, 6 cwt., plus 3 cwt. kainit ..	42 6	55 7	48 16
Mixture A, 6 cwt., plus 3 cwt. salt ..	38 10	54 14	46 12
Mixture A, 6 cwt., plus 1 cwt. sulphate of potash and 3 cwt. salt	34 2	55 6	44 14
Mixture A, 6 cwt., plus 1 cwt. sulphate of potash	32 16	51 5	42 0½

Carrots.—Ten varieties were tested, Matchless White again proving best with a yield of 45 tons 3 cwt. per acre, compared with Guerande, 44 tons 19 cwt., and Barriball, 38 tons 15 cwt. The manure used was the mangold mixture A at 5 cwt. per acre.

Swedes.—Nine varieties of swedes were grown, Grandmaster weighing the best with 57 tons 16 cwt., Masterpiece second with 46 tons 9 cwt., and Studsgaard Itamme third with 45 tons 9 cwt., per acre. Several imported varieties, including Bangholm Pajberg and Bangholm Klank strains, that had a reputation for club-root resistance, proved more susceptible than our standard strains, the two Bangholms being practically wiped out. A test was also carried out between seed treated at the Biological Laboratory, Wellington, and untreated seed from the same package. The treated seed showed a much lower germination than the untreated, and a consequently lighter crop, the per-acre yields being 39 tons 3 cwt. and 46 tons 9 cwt. respectively. Club-root was found on both plots. The treatment was mainly in the direction of controlling dry-rot. When weighing, one root affected with dry-rot was found on the treated area, and three on the untreated area. The crop

in this field, both treated and untreated, could be classed as nearly free from dry-rot. This is important, as the same field grew swedes in 1922—the first crop after stumping—and practically the whole of the 1922 crop was lost from dry-rot.

Soft Turnips.—Eighteen varieties were tested, including a number of Danish and new English strains. These roots were grown on land that had been in swedes four years ago, and all were appreciably infected with club-root. There were two or three promising turnips among the new varieties, but nothing so far to warrant them taking precedence over standard varieties such as Imperial or Hardy Green Globe, Red Paragon, and Devonshire Greystone. These varieties are still giving excellent results in Taranaki, and are hard to beat.

CHOU MOELLIER.

Several acres of chou moellier were grown, but the crop was only fair, the lower-lying portions of the field being the poorest; evidently this crop likes good drainage. Chou moellier is very resistant to club-root, but it was found that, although the plants did not die down, club-root greatly retarded the growth of the crops on the wetter areas. An interesting experiment was carried out to test the degree of resistance of the plant. An area of ½ acre was sown in swedes about the middle of December. These germinated well and made splendid growth up to the middle of January, when it was noticed that they were affected by club-root, and by the end of the month practically every swede-plant had gone down with this disease. The area was immediately ploughed and sown with chou moellier, and a splendid, healthy crop was produced which carried right through to August.

DAIRYING RETURNS.

Owing to a change in herd bulls being necessitated a number of the best cows were three to four weeks late in coming into profit. Notwithstanding this fact and the bad spring, the increase in butterfat production for the year was 934 lb., and the total of 19,448 lb. of butterfat actually sent to the factory must be regarded as satisfactory. Table 2 gives details of butterfat production on the farm for the past eight years.

Table 2.

Year.	Butterfat per Cow.	Butterfat per Acre.	Yearly Increase per Acre.	Total Butterfat.
	lb.	lb.	lb.	lb.
1920	221·1	60·8	..	8,694·4
1921	274·2	88·7	27·9	12,684·1
1922	298·9	104·5	15·8	14,943·5
1923	280·0	98·6	—5·9*	14,099·8
1924	305·0	108·9	10·3	15,572·7
1925	327·0	121·3	12·4	17,345·9
1926	330·5	129·4	8·1	18,511·3
1927	329·6	136·0	6·5	19,448·0

*Decrease.

The season was commenced with fifty-six cows and seven two-year-old heifers; no stock was bought. For various reasons two of the cows

were not milked, and were sold in September. Two cows and two heifers did not come into profit until December and January. This makes fifty-two cows and seven heifers all told, with a return of 329·6 lb. butterfat per head. A further analysis shows that the cows averaged 337 lb. and the heifers 275 lb.

General expenditure on manure works out at 16s. 5d. per acre, but it must be remembered that a fair amount of this is spent in the purchase of fertilizers for experimental purposes, some of which is not of actual value to the farm.

The Manager, Mr. W. J. Grierson, and his assistants have carried out their duties in a very thorough manner, and they are to be congratulated on the results obtained. Mr. A. J. Glasson, Fields Instructor, Hawera, assisted in the sowing and weighing of most of the crops, and the value of his work is greatly appreciated.

PROPERTIES OF SUPERPHOSPHATE.

In the course of an address to the Board of Agriculture on the subject of the mineral content of pastures, Mr. B. C. Aston, Chief Chemist, Department of Agriculture (who is directing that research in New Zealand), stated with reference to superphosphate that few farmers realized the triple quality of this valuable manure, which, in addition to supplying phosphorus, also supplies large quantities of calcium and sulphur, all three being elements essential to the nutrition of the animal. The response of crops and pasture and the stock grazed on them to superphosphate might therefore not always be solely due to the phosphoric acid. If it was due to the calcium or sulphur there were cheaper ways of supplying them than in super. In any case there should always (except in the case of sandy lands) be enough carbonate of lime in the soil to combine with the superphosphate and prevent the reversion to insoluble, unavailable compounds of iron and alumina. Sandy land, he added, should not be limed, but improvement of its texture sought by means of green-manuring.

MOTTLED HEART OF SWEDES.

A disease of swedes, known as "mottled heart," has been particularly abundant for many years past in Westland, and a considerable amount of experimentation has been from time to time carried out on it. A further set of experiments established in December, 1925, gave some very important results, which are briefly as follows: (1) None of the common artificial fertilizers exerted any deterrent effect upon the disease, which was very prevalent; (2) some of the fertilizers certainly increased the weight of the crop per acre, but this was commonly accompanied by a greater percentage and a greater intensity of the disease; (3) wood-ashes, on the other hand, gave very little improvement in weight per acre of crop; (4) wood-ashes, however, decreased or even eliminated the disease entirely, according to the quantities used; (5) the greater the weight per acre of swedes the greater the requisite quantity of ashes to secure a healthy crop. The experiments commenced at Waimaunga Experimental Farm, Grey Valley, in December, 1926, to ascertain what constituents of the wood-ashes were preventing the occurrence of the disease were entirely destroyed by floods.—*Annual Report of Fields Division, 1926–27.*

Analysis of treated House-refuse.—A sample of the product of the Wellington City Corporation's house-refuse masticator was analysed recently at the Department's Chemical Laboratory. The sample, after drying, contained over 50 per cent. of organic matter, but almost negligible amounts of nitrogen, potash, and phosphates.

SEASONAL NOTES.

THE FARM.

CEREAL HARVEST.

CEREALS should be cut as nearly as possible at the correct stage of ripeness. If cut too early the grain shrivels, and if cut too late there is a risk of a loss by shaking. Four main stages or degrees of ripeness can be easily recognized. In the milky stage the contents of the grain when squeezed are fluid, and if cut at this stage the grain shrivels; next comes the stage of yellow ripeness, when the contents of the grain are doughy and may be easily cut through with the finger-nail; in the fully ripe stage the grain is hard, but the straw yellow; in the final stage, or stage of dead-ripeness, the straw is white and the nodes shrivelled. The time occupied by the grain passing from the first to the fourth stage depends on the season. In hot, dry weather the change is very rapid, and where large areas have to be dealt with a start must be made on the early side.

Wheat should be harvested at a definite stage in yellow ripeness, and this has been described by Hilgendorf ("The Best Stage for cutting Wheat," this *Journal*, June, 1923) as follows: "General aspect of crop—ripe-coloured, but close scrutiny showed green tinge. Straw—all yellow except about 1 per cent., which showed 3 in. of green above the top knot; all knots green. Heads—ripe-coloured except about 1 per cent. still green. Grain—that in ripe heads would not squeeze out any kind of dough, but cut easily with thumb-nail." This stage is the earliest at which wheat can be cut without causing loss in weight from shrivelled grain. The prevalence of strong winds in wheat-growing areas, and the serious loss that is often caused through shaking in a ripe crop, make it unwise to delay cutting beyond this stage of ripeness.

Oats can be cut slightly greener than wheat, and if intended for chaff early cutting is desirable. Oat varieties differ in evenness of ripening and liability to shaking. Duns and Tartars, for instance, shake badly because the grain ripens very unevenly; Garton's Abundance ripens fairly evenly, but loses grain badly if left till quite ripe. Generally speaking, the crop should be cut when there is a nice uniform yellow colour all over, but just before the greenish tinge has entirely gone. The grain should be well filled and fairly firm, but not quite hard.

Barley for malting is usually left till dead-ripe, as if cut before this the germination of the sample is uneven, which is a disadvantage in the production of high-class malt. At the stage of dead-ripeness the ears tend to bend over, the individual grains are hard with pale-yellow wrinkled skins, and the straw is practically dry.

Cereals should be stooked as soon as cut, and the work of stooking is lightened considerably if the binder is fitted with an efficient carrier and the man operating the binder drops the bundles in straight rows. The stooks should be placed so that the prevailing wind may blow straight through. The crop usually requires at least a fortnight in the stook before it is ready to stack or thresh. If stacked, it should not be

threshed until at least six weeks after stacking, so as to allow completion of the sweating process to which the grain is subjected to in the stack.

FEEDING IN RELATION TO PASTURES AND CROPS.

The time of weaning and method of subsequent feeding of lambs depend entirely on the farm-management method adopted under given climate, soil, and topographical conditions. Where sheep are entirely grass-fed, weaning should take place while there is still plenty of good grass available, and the lambs should be placed on the best pastures. In this way they get used to foraging for themselves before the grass goes off in the autumn.

The management of fat lambs is rather different from that adopted for flock sheep. Under North Island conditions it is usually possible to get 80 per cent. or over of Southdown-cross lambs fat off their mothers, and the remaining lambs will be weaned after the last draft of milk lambs has been got away. In the drier, arable farming districts rape is necessary for fattening the majority of the lambs after the grass dries up in midsummer. Lambs should be allowed a day or two on grass paddocks to settle down after weaning before they go on the rape. Rape is a very heating food, and the lambs on this crop should be watched carefully. Mustard is a good dietetic, and should always be sown with the rape. As the mustard matures earlier than rape it should be sown about a fortnight later. A run-off from the rape on to a grass pasture is also desirable.

Early weaning is generally desirable in the case of calves. If weaned at four or five months they get used to foraging for themselves before the grass goes off badly in the autumn. The more adequate feeding of calves during the dry autumn weather is a point which could receive more general attention from dairy-farmers. If the pastures dry up badly the calves should receive some green feed. If soft turnips are being fed out to the milking-cows the calves can be allowed access to these roots before the cows. They usually confine their attention to the leaves, and this will minimize the tainting effect of the turnips when eaten by the cows.

There are two main points to be considered in the provision of supplementary feed for milking-cows in the late summer and autumn: (1) The method of supplying the supplementary feed—whether by annual forage crops, by ensilage, or by permanent forage crops such as lucerne or paspalum; (2) the feeding-value of the fodder—it should be rich in protein.

Annual forage crops are usual on those dairy farms where some grassland has to be renewed each year, while grass ensilage is the more common summer supplementary feed on farms where the pastures are practically permanent. In the selection of annual crops for summer supplementary feeding the important points are the yield, the feeding-value, and the length of time the crop is available for feeding-out. The popularity of soft turnips as a summer and autumn supplementary crop is due to their high yield, high feeding-value, and to the fact that by the use of successional sowings and early- and late-maturing varieties a supply of mature roots can be made available from the late summer to the early winter. The soft turnip, however, has the disadvantage that it taints the milk if care is not exercised. The roots should be pulled the day before feeding and carted out to

a clean grass paddock. There is, however, practically no other annual fodder crop that can equal the soft turnip as far as yield, feeding-value, and length of feeding-period are concerned. Japanese millet has a much lower yield, and, unless grazed in the young stage, a lower feeding-value. Maize, pumpkins, and marrows are rarely ready for feeding-out in the late summer; again, maize is of poorer feeding-value than turnips and marrows, and pumpkins are usually lower in yield.

Provision of summer supplementary feed by means of grass ensilage is cheaper than by means of annual crops, and it also has the advantage that the feed is always on hand when required. The need for summer and autumn feed varies from year to year. When the summer and autumn rainfall is plentiful annual crops yield well but are often not needed, while in dry years, when summer supplementary feed is most required, these crops often do badly. Grass ensilage can, however, be made in years of abundant rainfall and kept for dry years.

Lucerne and paspalum are valuable supplementary crops for the summer and autumn. In wet seasons, when the ordinary permanent pastures are throwing a good supply of feed, the surplus lucerne or paspalum can be saved as hay or ensilage.

—P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.

THE ORCHARD.

FINAL THINNING.

By the time these notes appear growers will be able to get a fairly good estimate of their crops for the coming season. Natural dropping will have ceased, and it will be easily determinable whether too much fruit is being left on the trees. As stated in last month's notes, growers are apt to leave too many fruits to mature. Now is the time to further examine the trees, going over them systematically, and removing any fruits likely to interfere with the development of the remainder. This will specially apply to those varieties bearing their fruits in clusters. The aim should be to produce fruits from $2\frac{1}{2}$ in. to $2\frac{3}{4}$ in. diameter, these sizes having been proved the most suitable both for local and overseas markets. Any diseased or misshapen fruits should be removed. It is also advisable to thin off all fruits growing towards the tops of the leaders, thus giving the trees every chance to make a good extension of wood-growth for the coming season. This will specially apply to Sturmers, a variety easily stunted in growth.

SPRAYING OPERATIONS.

Although there may have been little evidence of black-spot up to the present time, it does not follow that crops will remain clean up to the picking season; consequently spraying should not be neglected, although longer intervals may be given between sprayings. As the holiday season is approaching, it is advisable to so arrange the programme that the orchard is sprayed just before the holidays start. By so doing the orchardist can forget all about spray outfits, &c., during the festive season, unless, of course, weather suitable for the development of black-spot intervenes. In such case practically the same strengths can be used as advised last month.

With the hot, dry weather approaching, red mite will probably be on the increase, and efforts will have to be made to reduce it to a minimum. Black Leaf 40, at strength 1-800 1,000, will help to keep this pest in check, and also help to control any leaf-hopper that may have escaped when in the nymph stage. Last season a grower in the Motueka district obtained splendid results in the control of red mite by the use of a 3-per-cent. kerosene emulsion. This was used in February, and the only disadvantage was that a few of the apples were spotted, in all probability owing to the fact that some free kerosene was present. The same grower has already used a 2-per-cent. solution this season, and the results have been very satisfactory.

One more fungicidal spray on the late maturing varieties of pears should suffice, and attention need then only be directed against codlin-moth and pear-slug, using arsenate of lead, 1½ lb. to 2 lb. per 100 gallons water. Stone-fruits must be sprayed up to a week or so before picking if brown-rot has to be controlled; lime-sulphur, 1 125, with the addition of 4 lb. of sulphur paste, will help much to control this disease.

Cherry-growers will probably be troubled with the slug just before the fruit is ready for picking. Hellebore-powder spray is very effective against the slug, and does not stain the fruit. It is also advisable to spray thoroughly as soon as the fruit is off, using arsenate of lead.

CULTIVATION AND COVER-CROPS.

Cultivation of the orchard should be continued all through the coming month by using the disks and harrows. This will help to conserve moisture, and also prepare the land for the sowing of cover-crops. One of the best cover-crops is blue lupin, the seed of which is usually sown towards the end of the month. Other green crops may be left a little later.

HANDLING THE STONE-FRUIT CROP.

Growers will be busy handling the stone-fruit crop about this time, and every consideration should be given to its marketing. It should be remembered that extra care taken in the grading and packing always pays. Unfortunately, too much low-grade fruit is sent to market, tending to reduce the returns for the better grades. All blemished and diseased fruits should be eliminated, and one size only packed in the case; clean cases should be used, and these properly labelled and stencilled.

The regulations with regard to the fair packing of fruit and vegetables should be carefully observed. These regulations prescribe that all fruit sold, or offered or exposed for sale, whether wholesale or retail, in a container shall be packed in such a manner that any fruit exposed to view, or that would be exposed to view if the container were opened in the normal manner, fairly represents in size, maturity, and condition the whole contents of the container. By the due observance of this regulation confidence will be established between grower and buyer, to the advantage of both.

Consideration should be given to the right stage of maturity for picking, according to the distance the fruit has to travel, so that when the fruit is opened for sale it will be as near perfect as possible.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

Cultivation should receive very close attention at this period; land which is inclined to be lumpy can usually be reduced to a fine condition while intermittent showers occur—a condition it is nearly impossible to attain with some soils when very dry. Citrus-trees in particular require constant cultivation to conserve moisture, as they make the greatest demand on the soil during the period of minimum rainfall. If for any reason it is not possible to maintain at least 4 in. of fine earth on the surface the trees should be mulched with rough manure or litter at least to the spread of the branches. If such manure is readily available it should be used even in preference to the clean cultivation. A word of warning is necessary in regard to the use of a mulch; when rough litter or decaying manure is piled up round the trunk of the tree there often occurs a decaying of the bark, which is injurious.

Pinching.—With the new growth well advanced it is possible to estimate its value to the tree for fruiting or extension, but it is generally found that the growth is in excess of requirements. Any surplus can be removed now, and will allow better development and maturity of that allowed to remain. There are also quite a number of shoots which may be partially removed by pinching, which has the effect of inducing more side laterals of a fruiting nature. At this season there will generally be found strong woody shoots growing up through the frame of the tree. These rarely prove of any value, and are best removed right at the base.

Spraying.—Owing to the prolonged flowering-period of the lemons it will be advisable to give periodical sprayings of bordeaux, 4–4–40, in order to protect the new fruits against verrucosis. An examination of the trees prior to such applications should be made to determine if aphis, thrip, or young scale insects are present; if so, Black Leaf 40, 1 part to 800, should be added. Verrucosis is seldom found on oranges, nevertheless examination should be made for young insects, and Black Leaf applied, or oil 1–60.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CULLING SURPLUS COCKERELS.

JANUARY is usually a trying month for birds of all ages. This, together with the fact that the plant at this time will be carrying its greatest number of stock, is sufficient to indicate that if the birds are to thrive and do well there must be no weakness in the chain of management. To lessen the risk of overcrowding and its evil effects there should be no delay in culling out all surplus cockerels that have reached an age of about five months. If these are got rid of it will not only mean better conditions for the remaining stock, but will also save labour and money. It should be remembered that once a bird passes the chicken stage it costs more to feed and grows less in value every day.

GREEN FOOD.

For both the growing and adult stock an ample supply of green material is necessary at the present time if the birds are to be maintained in good health. Green food not only greatly assists in keeping the birds in a healthy, thriving state, but it saves to a great extent the more costly foods, and thereby lessens the cost of production. Finely chaffed succulent lucerne, clover, or green oats provide a splendid green food for birds of all ages, while watercress, silver-beet, cabbage, &c., are also suitable. It is always best at this period of the year to provide green material late in the day, so that any of it not readily eaten by the birds will not become dried up and wasted.

THE GROWING STOCK.

The growing pullets must now be given the very best of care, so that they may not fail in their future function of producing late autumn and winter eggs. The slightest setback in a growing bird is never caught up. One thing that must be carefully guarded against is forcing the birds to prematurity. It is time enough to begin feeding a heavy forcing diet when the birds are well developed and are fit to stand the strain. An undeveloped pullet cannot be expected to commence laying at an early age and at the same time make further growth. Indeed, and in a general way, once the pullet commences to lay she ceases to grow. This is because the energy necessary to reach maturity will obviously have been diverted to egg-formation. In short, pullets of any breed should be prevented, if possible, from commencing to lay till they are at least six months old.

While the inclusion of rich foods, such as meat, in the ration for the undeveloped layer is a mistake, this is not to say that her diet should be stinted. The pullets should be fed as well as possible, but on a plain diet of sound grain materials. Green food should be in ample supply, while a good range should be provided if possible. It is impossible to advise as to the daily amount of food a developing bird should receive, as the weather conditions must be taken into account. During extreme hot-weather conditions the young birds are apt to more or less go off their food. The only safe way of making sure that the young birds get all they require is to have food in a dry state always before them. One part good-quality wheatmeal and two parts bran will provide a good dry-mash mixture. This should be supplied in a proper dry-mash hopper, so that the food will not get wasted; moist feed can be given at ordinary feeding-hours. For keeping the young birds steadily growing there is nothing better than good, plump oats, preferably shelled. The latter are now on the market in most places, and when obtainable they should form a large proportion of the growing pullet's grain ration. An inferior grade of unshelled oats should never be fed, as they are next to useless as a poultry-food.

Above all, care should be taken that the growing birds are not tortured by the presence of vermin. These pests breed rapidly at this period of the year, and if they are to be kept in check it is necessary to pay strict attention to cleanliness and give the quarters frequent spraying with a strong disinfectant. No care or attention is too great for the growing pullet.

LIBERAL FEEDING NECESSARY.

One of the worst mistakes in management which has come under my notice during recent visits to poultry plants is the false economy of stinting the laying flock in food. It is almost impossible to overfeed the laying type. It may be said that if you overfeed some birds they will only put on fat. The reply is that this type should have no place in a laying flock. Such stock are fat because they are not of the correct laying type and obviously are not concerned in heavy egg-production. In other words, they utilize the food consumed to make fat and flesh, while the good layers convert it into eggs. If any argument is required to disprove the common fallacy that the heavy-producing bird can be overfed with the right class of food, it is surely the fact that the thinnest birds at this time of year are almost without exception the heaviest layers in the flock. A high-type layer—and this type is now becoming very common in the Dominion—is regarded by many poultry-keepers as a fowl which will give a great artificially induced yield of eggs on a food-supply which will satisfy a bird in its natural state. If a bird is to lay eggs almost every day for the greater part of the year she must have the material to do it with, and at the same time sufficient to maintain her in sound health while undergoing the great strain on her constitution. It is always a sounder policy to reduce the flock rather than reduce or weaken the ration.

On one plant that I recently visited the owner was most anxious to know how to prevent his birds from getting out of their run. He stated that part of the feathers of one wing was cut, and the wire-netting enclosure was 6 ft. high, yet some of the birds got out. After examining the stock the inquiry was easily answered. They were in anything but a thriving condition, indicating that the starving process was in operation, or that the food supplied was of inferior quality. Usually the best layers in the flock give most trouble by getting out of their run, as they must necessarily be heavy feeders. Thus where they are kept on a mere living-diet it cannot be wondered at that they will make every possible effort to get to a free range in order to search for the food that nature demands. In such cases it may be for the purpose of securing green food, grit, or egg-shell-forming material through lime, as in too many cases these essentials are undersupplied.

The good laying bird must be a contented bird; only in this condition can she be expected to do the best. To achieve this, good food and a liberal supply of it are essential; but it should be remembered that the best bird ever bred or the best food ration ever planned will not spell success if the management is wrong in all other respects. Comfortable, well-ventilated, clean houses that are free from insect pests must go with sound and liberal feeding if maximum results are to be obtained.

It may be added that even a well-fed fowl will sometimes be induced to get out of its run where there is a batten on the top. This, of course, is a mistake, as plain wire at the top, centre, and bottom of the posts is all that is required to support the wire netting between the posts. A bird may also be tempted to get out of its run in order to lay its egg in some outside place rather than visit vermin-infested nests which are so common on badly managed plants.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SWARMING.

THE most important work engaging the attention of apiarists at this season is that of checking the impulse of the bees to swarm. This operation, together with preparations for an active honey-flow, is likely to crowd the beekeeper's time. For the production of maximum crops of honey all experienced beekeepers admit that swarming should not occur, and, while skilful attention is required to eliminate it altogether in most apiaries, it is a common occurrence.

It is natural for bees to swarm, but what condition of the colony causes them to swarm at this particular season, and not at another period, is not quite understood. Were it possible to understand the natural condition which suggests to the bees that it is time to swarm, our efforts could be directed to the control of that condition. Many theories have been advanced as to the cause of swarming. It is contended that swarming is caused by lack of ventilation, overcrowded colonies, and the presence of old queens in the hives. The beekeeper should therefore endeavour to effect a reduction of these causes.

As ventilation plays an important part in controlling swarming, care should be taken to provide sufficient at all times. An effective method is to place blocks 1 in. in height under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest ; this forms two additional entrances, and permits the workers to escape to the field without having to traverse the whole depth of the hive.

Space for the storage of honey and additional room for the queen to lay in must be provided in advance of the colonies' requirements. A suitable plan is to give a new brood-chamber comprising two frames of hatching brood, the remainder being frames of foundation or drawn-out combs. Secure the queen and confine her below an excluder in the new chamber. Then place the old brood-nest directly above, thus giving additional work for the young bees, and plenty of room for the queen to lay in. Young queens are essential factors in the successful control of swarming ; colonies show less inclination to swarm where the queen is of the current season's rearing. Every effort, therefore, should be made to requeen early in the spring, or, if this practice is not possible, to head each colony with a young queen in the autumn. If this plan is followed, swarming will be considerably reduced in many of the colonies, and attention will only need to be directed to those colonies showing a tendency to swarm.

The method of clipping queens is not generally practised. It consists in cutting off half or more of each wing on one side, and has advantages. It serves to mark the queen, and prevents the swarms from absconding or from settling in high trees out of reach.

FOUL-BROOD.

As advised last month, all hives affected with this disease should be treated immediately, and the colonies got into good order before the main honey-flow commences.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE TOBACCO CROP.

THE earlier plantings of tobacco will now commence to develop a spike of flower-buds, and cultivation should be discontinued. When the majority of the plants reach this stage the flower-buds should be broken off—an operation known as "topping." Usually this topping is done too high, with the result that the leaves do not fully mature nor attain normal size, especially those high up on the stem. On the other hand, if the topping is too low the remaining leaves become coarse, with large woody veins and ribs, and are subject to disease. For this reason the policy to be adopted in topping requires careful consideration of the soil, weather, condition of the plants, and the purpose in view. For flue-cured yellow leaf coarseness is a serious defect, and topping is done generally rather higher than for air-cured brown leaf.

The check given to the plant by topping results in young growth developing in the axils of the leaves, as well as diverting the sap into the leaves themselves and giving them size, body, and texture. The extent of this young growth will depend on the height of the topping operation, but in any case it may be removed at regular intervals as soon as it is large enough to handle. This is known as "suckering." The quality of the crop of leaves will depend to a great extent on the way this work is done. It must also be carried out promptly, so that the plant may be brought to maturity without loss of time and the harvesting-period reached during the warmer weather, which is of great assistance in making a successful cure.

At the same time the preparation of the curing-barns must be completed in ample time for the harvest, so that this may be carried out without delay as soon as the plants are ready and the weather is suitable.

It should be needless to state that in all the above-mentioned operations traffic through the crop should be carried out in such a way that the leaves are not broken or bruised, as such injuries discount the value of the leaf.

TOMATOES.

Careful feeding and ample ventilation at this season for tomatoes growing under glass will keep the plants healthy, and fill out the remainder of the crop in a satisfactory manner before the main outdoor crop comes on the market.

The outside crop will require close attention, and probably a dressing of fertilizers to help them mature the crop that should now be setting. Continue to keep a sharp lookout for any sign of disease, and when detected deal with it promptly. Select a few plants of good constitution that are carrying a heavy crop of a suitable type. These should be marked and allowed to mature the fruit on the vines with a view to saving it for seed. Store the seed from each plant in a separate package.

Last month's remarks regarding packing cannot be repeated too often. Fall into line with local practice in regard to the size of case, and pack in it fruit of a definite grade of approximate size. Brand with the recognized distinguishing marks. Such concessions to

standard uniformity facilitate the operations of marketing that are of such importance when selling a perishable product. Some packers fear losing the individuality of their pack by such concessions, but that quality will come out if it is there, by consistent maintenance of the grades. Buyers will get to know the name or number of the grower as one that is reliable, and the pack will receive the advantage of being bought with confidence.

MARKET-GARDEN CROPS.

Planting out the winter's crops now demands first consideration. If the weather is inclined to be dry and difficult it would be as well to spray the plants with tobacco concentrate and lead, in order to clean them up well and protect them from insect attack before they are lifted. When lifting the plants select an even grade, rejecting weak and abnormal specimens. The opportunity to set out the plants in dull showery weather should not be missed; much is to be gained by being ready to take advantage of suitable weather.

The celery crop must not be allowed to become dry, and most of these crops as they become established will receive benefit from a small application of nitrates to keep them moving and ready to respond to that short period during the autumn when their growth has to be just about completed.

Growers of late-sown crops of onions attacked by mildew might try dusting the crop with sulphur or spraying with liver of sulphur (sulphide of potassium), at the rate of 1 oz. to 3 gallons. It has been highly recommended by some authorities recently.

Useful autumn crops that may be sown now are dwarf beans, short-horn carrots, turnip-rooted beet, early peas, spinach, and turnips.

GARDEN PLANNING.

As the autumn season is the best time for laying out the homestead garden or making alterations, it is appropriate to give the matter some attention now. Difficulties and dissatisfaction usually arise through plans being carried out before careful consideration has been given to the subject. The importance of the work demands as much care as the designing and specification of the dwellinghouse, and if the same thought is given to it there is no reason why it should not be quite as appropriate and in harmony with the surroundings.

To those who have such work in view the following suggestions are offered: The extent of the garden should be proportioned to the size of the dwelling. The lawns are most satisfactory when they are smooth but follow the natural contour of the land. Access for vehicles is best given by the easiest and generally most suitable route. Gates and other garden architecture should harmonize in design and proportions with the dwelling. Owing to the great amount of work entailed in keeping garden-paths in order they are best reduced in extent as much as possible. Short grass makes the pleasantest walking, and the amount of traffic is unlikely to wear it out in many places where metal walks have been made.

Common mistakes are to plant high inflammable shelter-trees too close to the dwelling, and to disfigure the lawn and make cutting

difficult by planting too many specimen trees and shrubs. Plants for such positions should have very special qualities for such distinction. Another mistake is to form extensive herbaceous borders composed of small groups of plants that require an enormous amount of attention to keep them in order.

In selecting trees, shrubs, and plants for the garden we cannot do better than follow nature. She has a special flora for warm and cold localities, river-flats, hills, and high country, and by adopting them the work is made easier, effective, and most suitable. This character should be brought out strongly, and the planting done chiefly in comparatively large irregular groups. In the higher and exposed situations a liberal selection should be made from the long list of conifers available, together with some of the hardier evergreen shrubs and alpine plants. In such a situation they will thrive as they do nowhere else. In warm localities near the sea, roses, palms (Phœnix or Washingtonia), selected oleanders and camellias, crimson hibiscus, bouvardia, brugmansia, citrus, vines, heliotrope and camphor, bougainvillea, mandevillea, bignonia, and solanum climbers all flourish, and if planted in generous groups will provide colour and perfume, and deliver us from the exceeding monotony from which most of our homestead gardens suffer. At one time nothing gave more pleasure than flowering or fruiting plants out of season in an unsuitable climate. Such conflicts with nature were undertaken with great zest, but the prize was obtained at great cost. The modern practice of co-operating with nature to the fullest possible extent not only secures an ample harvest, but harmonizes with the genius of the locality, and attains a distinction to be obtained by no other methods.

Plans for new gardens or alterations to old ones should be carefully planned now for execution during the autumn months.

—W. C. Hyde, Horticulturist, Wellington.

THE DEER PEST.

THE last annual report of the State Forest Service refers to this matter as follows: "All (forest) conservation regions report an increase in these vermin, and this Service again places on record its opinion that protection on all species of deer (except moose and wapiti) should be removed for a period of at least three years, and that payment of a bounty on killed deer should be continued during that time. Protection has been removed from this pest on the State plantations throughout New Zealand, and during the latter part of the period under review the Service inaugurated a campaign for the destruction of deer on these areas. This included the payment of a bounty of 2s. per tail on all deer killed in plantations, the carrying-out of poisoning experiments, and the establishment of salt-licks for the purpose of attracting deer to places where they might be easily shot. Forest Service officers acting as receivers of deer-tails for the payment of bounty report the collection of 2,946 tails, of which 2,001 tails were received at Tapanui from the vicinity of the Blue Mountains, Otago."

Soil Survey Work.—Soils of the deteriorated hill country of the Stratford-Whangamomona district have been the subject of inquiry, and some samples have already been taken by the Chemistry Section of the Department. It is proposed to extend this work during the present summer.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

DURING the past month of November 126 cows received certificates under the C.O.R. system; details of the records are given in the appended list.

NEW JERSEY CLASS-LEADER.

Keston Flower, who until recently was leader of the junior two-year-old Jerseys, now goes to the head of the four-year-old class for that breed. As the list shows, she has been issued a certificate on a production of 814·95 lb. butterfat from 14,679·2 lb. milk yielded in 365 days, at a commencing age of 4 years 64 days. This exceeds the previous highest performance for this class, held by Mr. A. J. Smith's St. Lambert's Bell, by a margin of 34·63 lb. butterfat.

Keston Flower, owned and tested by Mr. G. E. Yelchich, of Waiuku, was bred by C. B. Herrold, also of Waiuku. Her dam, Floral Fox, has a C.O.R. for 469·58 lb. butterfat. Her pedigree contains several of the better-known names of the Jersey breed. Eminent's Fontaine appears on the sire's side, and Majesty's Fox twice on the dam's. Doubtless much of Keston Flower's productive ability originated in these two outstanding lines.

So far as the class-leadership record is concerned, the four-year-old Jerseys have always been, comparatively speaking, more or less below the standard of the remaining classes of the breed. It is satisfactory to note that Keston Flower has done much to remove this anomaly.

LIST OF CERTIFICATES ISSUED, NOVEMBER, 1927.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Oaklands Silky	F. W. Cornwall, Bell Block	2 56	240·1	305	9,504·4	595·18
Juanita's Fairy	Hellyer Estate, Dunedin	2 44	244·0	305	10,204·3	587·68
Proud Janette	A. S. W. Hazard, Waimate N.	2 6	241·1	305	8,407·3	587·16
Rosy Creek Comely	T. H. Western, Bell Block	2 43	244·8	350	9,702·0	574·69
Monavale Doreen	R. Haylock, Ngaere	2 8	241·3	365	9,508·6	564·29
Erinview Dawn	J. Murray, Woodville	1 335	240·5	305	9,464·7	560·27
Erinview Flatter	J. Murray, Woodville	2 16	242·1	365	9,074·3	547·79
Queen Ailsa	J. Murray, Woodville	2 18	242·3	365	9,326·8	544·75
Cupid of O.K.	A. E. Watkin, Takanini	1 351	240·5	357	8,793·3	530·09
Queen Mirnee's Avola*	J. Murray, Woodville	1 304	240·5	305	10,245·4	528·10
Ivondale Scotch Lassie	A. E. Watkin, Takanini	2 0	240·5	305	9,123·1	518·04
Erinview Buttercup	J. Murray, Woodville	1 329	240·5	305	8,771·5	513·71
Jerseydene Maiden	T. Wells, Awakino Point	2 42	244·7	305	8,895·7	511·63
Waipiko Jocose	C. G. C. Dermer, Waipiko	2 24	242·9	305	8,343·9	501·14
Tokorangi Dainty Queen	N. Moore, Tapanui	1 279	240·5	365	8,942·6	484·29
Beachville Cuddlesome	S. H. Wearing, Richmond	2 12	241·7	365	9,267·1	483·67

LIST OF CERTIFICATES—*continued.*

JERSEYS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
Junior Two-year-old—continued.		Yrs. dys.	lb.		lb.	lb.
Firland Princess	H. J. Addenbrooke, Ngaere	1 351	240·5	365	10,013·4	471·34
Oxford Dale Ena	J. T. Entwisle, Cambridge	2 10	241·5	365	7,607·2	457·82
Beachville Ventura	S. H. Wearing, Richmond	1 346	240·5	365	8,321·5	449·79
Pukepapa Melody	H. Cole, Tikorangi	2 10	241·5	329	7,457·7	448·93
Ghazal	J. C. Davidson, Dannevirke	2 41	244·6	365	6,880·8	446·94
Jerseydale Vera	J. Pettigrew, Pihama	1 362	240·5	365	6,729·9	443·05
Corelli's Pearl	W. Johnson, Ngaere	2 11	241·6	348	8,165·7	438·45
Middlewood Cowslip	A. Stackhouse, Kiwitea	2 4	240·9	365	8,047·7	436·39
Clarissa of Aria	M. V. Reeve-Smith, Aria	1 362	240·5	365	7,221·0	435·87
Ivondale Rose Bloom	Dr. C. G. Aickin, Auckland	2 14	241·9	365	7,961·9	435·48
Dainty Lady of O.K.	A. E. Watkin, Takanini	1 295	240·5	365	7,970·0	424·97
Summertime of Tamahere	F. S. Veale, Tamahere	1 335	240·5	355	7,475·2	422·41
Linden Grove Beauty	Mrs. M. A. Gadsby, Stratford	2 4	240·9	365	6,231·4	411·84
Roslyn Genoa Lady	A. J. Harris, Bombay	2 14	241·9	365	6,661·6	408·05
Roslyn Beauty	A. J. Harris, Bombay	1 333	240·5	365	6,698·8	403·54
Coniston Baby	R. Waterhouse, Ardmore	1 311	240·5	365	6,701·5	402·83
Maori Golden Iris	A. E. Watkin, Takanini	1 346	240·5	365	6,984·8	399·22
Spring Hill Dahlia	A. J. Harris, Bombay	1 355	240·5	365	6,602·2	398·86
Miro Meadows Darkie	A. A. Ward, Tariki	1 309	240·5	364	6,490·0	397·98
Vernon Golden Willow	D. J. Cooper, Masterton	2 75	248·0	363	6,934·2	394·11
Tauwhare Silver Lining	Dr. C. G. Aickin, Auckland	2 20	242·5	335	7,493·4	388·22
Rotoma Lady Hope	J. S. Rae, Taneatua	2 1	240·6	311	6,517·4	381·15
Rotoma Palm	J. S. Rae, Taneatua	2 29	243·4	303	6,899·5	378·59
Nettle's Beauty	R. Maddren, Winchester	1 327	240·5	365	7,754·5	375·42
Roslyn Favoured Princess	A. J. Harris, Bombay	1 311	240·5	365	6,411·9	368·02
Jersey Lea Fair Maid	J. T. Entwisle, Cambridge	1 364	240·5	365	5,997·6	353·47
Maori Guelder Rose	A. E. Watkin, Takanini	1 363	240·5	365	6,874·1	353·33
Rotoma Maid	J. S. Rae, Taneatua	2 19	242·4	312	5,982·0	345·10
Ribbonwood Girlie	Cook Hospital Board, Gisborne	2 58	246·3	321	7,453·3	344·79
Kelvin Dark Beauty	G. Buchanan, Paeroa	1 360	240·5	365	6,227·7	342·00
Waiwetu Bubbles	A. J. Miller, Uruti	1 324	240·5	331	6,283·0	341·37
Woodlands Xenia	H. C. Sampson, Hillsborough	1 275	240·5	365	5,442·1	333·17
Kelvin Sensation	G. Buchanan, Paeroa	1 306	240·5	363	5,759·8	322·34
Woodlands Merry Maiden	H. C. Sampson, Hillsborough	2 29	243·4	271	5,940·4	314·65
Miro Meadows Wai	A. A. Ward, Tariki	2 2	240·7	365	5,464·6	304·51
Heatherlea Primrose	H. J. Lancaster, Levin	1 350	240·5	358	6,581·8	301·23
Burrwood Bonnie Maid	J. B. Tonar and Son, Northcote	1 360	240·5	290	4,646·5	253·84
Spring Meadows Twy	D. M. Finnie, Westmere	2 17	242·2	328	4,480·5	253·07
Spring Meadows Mere	D. M. Finnie, Westmere	2 84	248·9	315	4,686·9	252·49
Senior Two-year-old.						
Carhuduff Camelia	J. O'Donnell, Bunnythorpe	2 287	269·2	365	10,941·4	650·74
Waipiko Greta	C. G. C. Dermer, Waipiko	2 243	264·8	365	10,321·6	590·53
Raeburn Tiny	J. S. Rae, Taneatua	2 206	261·1	344	8,244·5	449·16
Manor Hussy's Island Queen	J. B. Tonar and Son, Northcote	2 138	254·3	365	7,418·0	428·34
Tauwhare Princess	Dr. C. G. Aickin, Auckland	2 355	276·0	298	7,576·8	404·03
Raeburn Lady	J. S. Rae, Taneatua	2 173	257·8	343	7,061·5	390·12
Coniston Hairbell	R. Waterhouse, Ardmore	2 285	269·0	347	7,808·5	376·71
Ivondale Princess Royal	W. H. Jakins, Christchurch	2 330	274·0	324	8,001 3	365·34

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Three-year-old.		Yrs. dys.	lb.		lb.	lb.
Tulip's Minta May ..	H. Cole, Tikorangi ..	3 284	305·4	365	12,203·6	746·30
Waipiko Chlorine ..	C. G. C. Dermer, Waipiko ..	3 212	298·2	365	12,465·0	637·43
Snow View Blossom ..	A. J. Miller, Uruti ..	3 345	311·5	345	9,396·8	607·93
Pecan	Boon Bros., Poroporo ..	3 354	312·4	341	10,465·1	582·97
Ensley Lady ..	M. G. McArthur, Auckland	3 295	306·5	365	9,715·5	579·20
Matai Nui Gladsome	C. J. Startup, Eltham ..	3 27	279·7	365	8,943·3	557·32
Waipiko Cajole ..	C. G. C. Dermer, Waipiko ..	3 345	301·5	365	9,611·0	556·90
Glenbriar Fancy ..	G. Taylor, Ngarua ..	3 302	307·2	365	9,301·3	542·52
Peggy of Stonewall ..	W. R. Grant, Timaru ..	3 341	311·1	365	9,901·3	521·33
Bridge View Cream Rose	A. E. Watkin, Takanini ..	3 239	300·9	365	9,338·5	512·11
Floral Fete of O.K. ..	A. E. Watkin, Takanini ..	3 0	277·0	365	9,758·6	511·08
Jet d 'Eau	A. E. Watkin, Takanini ..	3 343	311·4	365	9,153·7	501·32
Viola of O.K. ..	A. E. Watkin, Takanini ..	3 254	302·4	293	8,306·1	457·09
Ivondale Gold Carnation	T. W. Perger, Waitara ..	3 269	306·9	326	8,365·4	445·22
Eileen's Gipsy ..	Dr. C. G. Aickin, Auckland	3 301	307·1	361	8,333·8	442·26
Colmore Owl's Eileen	D. Marra, Dargaville ..	3 349	311·9	267	6,623·7	372·39
Middlewood Rosalind	T. Watson, Wanganui ..	3 357	312·7	217	6,049·4	370·06

ROSINA BUCKMAN (A. S. HAZARD, WAIMATE NORTH).

C.O.R. in Jersey senior two-year-old class: 11,187·6 lb. milk, 675·82 lb. butterfat.

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS—*continued.*					
Four-year-old.		Yrs. dys.	lb.		lb.	lb.
Keston Flower* ..	G. E. Yelchich, Waiuku ..	4 64	319·9	365	14,679·2	814·95
Ivondale Golden Star	C. J. Masters, Hunterville ..	4 326	346·1	337	11,417·4	642·00
Marshlands V.C.* ..	G. E. Yelchich, Waiuku ..	4 41	317·6	365	8,199·6	568·74
Heatherlea Gem ..	H. J. Lancaster, Levin ..	4 6	314·1	364	9,480·1	519·52
Vernon Fuchsia ..	D. J. Cooper, Masterton ..	4 28	316·3	365	9,457·9	504·00
Hillview Famous ..	Dr. C. G. Aickin, Auckland	4 331	346·6	365	9,448·9	490·23
Meadowvale Machree	A. J. Miller, Uruti ..	4 260	339·5	364	8,616·9	478·64
Abberly Lila ..	Boon Bros., Poroporo ..	4 255	349·0	330	7,993·0	464·76
Oakland Leoana ..	Dr. C. G. Aickin, Auckland	4 313	344·8	365	7,185·2	459·15
Mature.						
Oakden Madge ..	J. O'Donnell, Bunnythorpe	8 353	350·0	365	13,433·3	792·52
Waipiko Charissa ..	C. G. C. Dermer, Waipiko ..	7 142	350·0	342	13,343·3	629·32
Alfalfa Madam ..	J. F. Barker, Wardville ..	5 361	350·0	365	10,675·9	622·74
Meadowvale Success..	A. E. Watkin, Takanini ..	7 3	350·0	365	11,502·2	608·67
Brookley Gem ..	W. Johnson, Ngaere ..	6 54	350·0	365	9,586·0	596·53
Silver Flower ..	A. E. Watkin, Takanini ..	7 325	350·0	365	9,353·8	569·59
Onaero Ladybird ..	Boon Bros., Poroporo ..	5 34	350·0	310	11,233·2	568·35
Palmdale Princess ..	D. Kennedy, Morven ..	5 285	350·0	365	8,110·4	556·21
Buttercup's Beauty ..	C. J. C. Powell, Opuawhanga	5 340	350·0	365	9,728·0	551·68
Marshlands Golden Lady	A. E. Watkin, Takanini ..	5 362	350·0	365	10,324·3	525·23
Master Pat's Belle ..	G. Buchanan, Paeroa ..	5 41	350·0	365	9,276·7	488·28
Ivondale Silver Link	Dr. C. G. Aickin, Auckland	7 334	350·0	365	8,890·6	478·06
Mountain View Cream	W. A. Burgess, Ruawai ..	5 300	350·0	365	8,596·4	467·62
Sterula	J. S. Rae, Taneatua ..	5 315	350·0	333	7,877·7	461·08
Richwood Mary ..	W. A. Burgess, Ruawai ..	6 66	350·0	357	7,721·7	402·46
Maori Cloudy ..	Dr. C. G. Aickin, Auckland	5 7	350·0	365	7,455·4	360·15
Mauriaena Laura ..	Dr. C. G. Aickin, Auckland	5 262	350·0	365	6,308·1	354·80
	FRIESIANS.					
Junior Two-year-old.						
Carlowrie Duchess Sylvia†	R. K. Macdonald, Edendale	2 17	242·2	364	13,339·8	460·27
Bloomfield Ormsby Fancy	Bloomfield Farm Co., Wellington	2 47	245·2	365	10,935·1	437·42
Senior Two-year-old.						
Pareora Model Cadilac	A. S. Elworthy, Timaru ..	2 217	262·2	365	15,053·0	549·12
Hillside Heather Queen*	Mickell Bros., Te Horo ..	2 335	274·0	365	12,052·2	495·40
Junior Four-year-old.						
Choice Segis Star* ..	H. W. Reeve, Waitoa ..	4 48	318·3	341	16,747·7	607·28
Pareora Netherland Butter Girl*	A. S. Elworthy, Timaru ..	4 23	315·8	365	16,167·4	536·52
Senior Four-year-old.						
Rosevale Sylvia Lassie*	Mickell Bros., Te Horo ..	4 363	349·8	355	15,356·0	612·29
Mature.						
Evergreen Mercedes*	Smart and Son, Tikorangi..	6 355	350·0	287	15,795·7	718·36
Hillside Duchess* ..	Mickell Bros., Te Horo ..	5 90	350·0	334	15,021·6	556·02
Carlowrie Tirania† ..	R. K. Macdonald, Edendale	8 323	350·0	324	18,167·4	532·93

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	MILKING SHORTHORNS.					
Junior Two-year-old		Yrs. dys.	lb.		lb.	lb.
Matangi Princess Elizabeth	Ranstead Bros., Matangi ..	2 13	241·8	365	7,778·7	360·24
Matangi Gipsy 4th ..	Ranstead Bros., Matangi ..	1 354	240·5	365	7,834·4	330·53
Matangi Princess Jewel	Ranstead Bros., Matangi ..	2 15	242·0	344	5,769·1	293·19
Matangi Princess Dorothy	Ranstead Bros., Matangi ..	2 20	242·5	328	6,222·3	260 41
Senior Two-year-old.						
Matangi Elizabeth 3rd	Ranstead Bros., Matangi ..	2 337	274·2	365	9,727·5	484·07
Junior Four-year-old.						
Matangi Princess 5th*	Ranstead Bros., Matangi ..	4 21	315·6	353	13,242·9	544·43
Mature.						
Matangi Pauline† ..	Ranstead Bros., Matangi ..	8 84	350·0	291	9,496·7	450·15
	AYRSHIRES.					
Two-year-old.						
Glengyle Mountain Mist	McAdam Bros., Queenstown	2 16	242·1	352	6,754·8	292·46
Glengyle Bessie ..	McAdam Bros., Queenstown	2 66	247·1	312	5,626·9	252·64
Three-year-old.						
Ivanhoe Ena ..	McAdam Bros., Queenstown	3 329	309·9	277	6,989·7	339·26
	Second-class Certificates.					
	Friesians.					
Totara Ruby Ripple*	Piri Land Co., Auckland ..	2 273	267·8	365	15,537·7	521·29

CONTROL OF BLACKLEG IN YOUNG CATTLE.

In his annual report for 1926–27 the Director of the Live-stock Division remarks: "Owing to the steady campaign carried out by officers of the Department against blackleg in parts of the Taranaki and Auckland Provinces the position in recent years has become less acute, and the mortality amongst young cattle has been reduced to such an extent that it was possible during recent years to relax the regulations in the Auckland District, so that calves were only inoculated on farms where an attack of the disease took place. As a result of the experience gained in the Auckland District the same methods were during the past season introduced into the Taranaki District and were found to work satisfactorily. Our present system, while safeguarding the health of stock, has been an enormous saving in labour both to officers of the Department and stockowners in the district. The regulations with regard to removing young cattle from the district are still in force."

Registration and Inspection of Plant Nurseries.—The annual report of the Horticulture Division for 1926–27 states that this work proceeded satisfactorily, the bulk of the nurseries being comparatively free from disease. There was an increase in the number of nurseries registered, the total being 637, as against 593 for the previous year; £637 was collected in registration fees.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GRASS MIXTURE FOR HARD BEECH RIDGES.

P. COATES, Pohokura :—

Could you advise as to a suitable grass mixture for hard sandstone beech ridges on bush and fern burns in this district ? I think the stocking and conditions would be too hard for Lotus major. Subterranean clover I have not yet properly tested, but it does best on the better low lands. Danthonia is the ideal thing but very uncertain to establish. Brown-top is our mainstay, but gets weak and dried up on hard knolls, especially in winter. Would Lotus corniculatus be better on hard hills than major ? Would you advise sweet vernal ? I am told Bokhara clover is of no value. We are troubled with short hard bracken and weeds on dry knolls.

The Fields Division :—

The type of ridges you refer to are specially hard, and it is difficult to get any grass to hold on them without top-dressing, which may not be an economic proposition on this class of land. Reliance will have to be placed on grasses such as brown-top and danthonia. Lotus major should prove the most useful of the Lotus family. Sweet vernal provides a certain amount of feeding, but is usually introduced in sufficient quantities as an impurity with other seeds. Subterranean clover is worth further trials, but, as you say, will probably do better on the stronger land. For sowing after a bush-burn the following mixture is recommended : Cocksfoot, 4 lb. ; brown-top, 2 lb. ; perennial rye-grass, 5 lb. ; Italian rye-grass, 5 lb. ; crested dogstail, 2 lb. ; Danthonia pilosa, 2 lb. ; Chewings fescue, 1 lb. ; colonial white clover, 1 lb. ; suckling-clover, ½ lb. ; subterranean clover, ¼ lb. ; yarrow, ¼ lb. ; Lotus major, ½ lb. ; paspalum, 2 lb. : total, 25½ lb. per acre. For sowing after second-growth and fern burns the following is a suitable mixture : Perennial rye-grass, 4 lb. ; Italian rye-grass, 4 lb. ; brown-top, 2 lb. ; Danthonia pilosa, 2 lb. ; crested dogstail, 2 lb. ; Lotus major, ½ lb. ; colonial white clover, 1 lb. ; subterranean clover, ¼ lb. ; yarrow, ¼ lb. ; Chewings fescue, 1 lb. : total, 17 lb. per acre. If any of the species mentioned in this mixture are already fairly established on the land it may be cut out. The rye-grasses will not hold long unless top-dressed, but they provide feed in the early stages, and thus attract stock to help in the control of second growth while the more permanent grasses are being established.

CONTROL OF BROWN-ROT ON APRICOTS.

M. B. FORD, Timaru :—

On page 130 of the *Journal* for August, 1926, the spray indicated for brown-rot of stone-fruits at petal-fall is lime-sulphur, 1 in 120, or self-boiled lime-sulphur, 8–8–50. In the column " Remarks " it is stated that " apricot-trees should not be sprayed with lime-sulphur spray." Would you kindly advise me what preventive treatment is best to adopt for this fruit. Also, is self-boiled lime-sulphur, 8–8–50, made by mixing 8 parts quicklime and 8 parts powdered sulphur direct with 50 parts water ?

The Horticulture Division :—

The sulphur sprays when applied to apricots in summer, while to some extent controlling brown-rot, are distinctly injurious to the crop. The best means known at present of controlling fungus disease attacking that crop is thorough sanitation at all seasons of the year, and an application of home-made bordeaux spray, 8–6–40, when the blossom is in the pink stage. Self-boiled lime-sulphur is prepared by placing 8 lb. flowers of sulphur and 8 lb. rock lime in a barrel and adding water gradually, keeping the ingredients wet but not submerged. Stir occasionally. When thoroughly slaked, dilute at once up to 50 gallons of water and apply the spray.

CALVING-AGE FOR HEIFERS.

E. TUCKER, Aramoho :—

Would you please tell me the best age for Jersey heifers to calve.

The Live-stock Division :—

This matter is governed by many circumstances—purpose, individuality, and custom being the most noteworthy. From a purely physiological point of view your question is easily answered. The constitution of an animal is placed under a very great strain if bred from too young; it should be permitted to reach as near maturity as convenient. That means a heifer should calve at about three years old. This is much older than will be found to be the prevailing custom. For various reasons heifers are frequently bred at fifteen months, calving at two years. But no reason can justify such a practice. Breed characteristics may be gained by breeding from a mere baby, but at the expense of constitution and after-production. The practice, in fact, is a short-sighted one.

POACHING OF RIVER-FLAT PASTURES.

"SUBSCRIBER," Te Mawhai :—

I should be obliged for advice as to treatment of my well-grassed heavy river-flat pastures. In winter the cows trample out and destroy the grass and puddle the soil, which sets hard at the first dry weather. The hard-baked condition appears to be only 6 in. to 8 in. deep. Would heavy liming be a remedy? If so, what quantities and when should I apply?

The Fields Division :—

From your account of the river-flat pasture it appears that you should look to drainage as an initial step towards improving the condition of the soil. If the drainage is adequate and satisfactory you should not get the poached condition in winter and consequent hard-setting when the dry weather comes on. Another consideration is that of stocking. Overstocking naturally tends, when the ground is wet, to poaching of the surface soil. Heavy liming would have a tendency to make the soil of the river-flats more friable, but it must be remembered that such treatment would only help to ameliorate a condition brought about by inadequate drainage and possibly overstocking.

IDENTIFICATION OF STOATS AND WEASELS.

E. H. AITKEN, Pleasant Point :—

Would you please tell me what is the difference between a weasel and a stoat. I always understood that a weasel had a thin tail, and that a stoat was a similar animal with a black brush tail. The other day I was told that both are stoats, one being male and the other female, and that a weasel is rarely seen in New Zealand and is a white animal.

The Live-stock Division :—

The stoat is closely allied to the weasel, from which it is chiefly distinguished by its superior size and the black tip on the tail, which is always black even if the fur is white; but the throat and under parts are never so white as in the weasel, and the tail is much longer and more bushy with black tip. The weasel is much smaller and more slender. In colour during summer the under parts are usually of some mahogany shade; the throat and chest are always white, the body and outer side of the legs the same as the body, generally a reddish-brown. The tail is short, round, not bushy, pointed, and of the same colour as the back.

NOTE.—"Inquirer, Levin" (inquiry regarding cow with catarrh), should supply his name, in order that an answer may be made.

WEATHER RECORDS: NOVEMBER, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows:—

November is usually a month of rapid air-movement and quick changes in the weather, but this year it was exceptionally so. It was remarkable also for the number of occasions on which cyclones, or centres of low pressure, passed either over or in close proximity to New Zealand. At the same time depressions of the "westerly" type were also fairly numerous. In this type no low-pressure centre appears on the area covered by our weather charts, but the pressure is low over wide areas to the southwards, and westerly winds prevail. The fluctuations of pressure are then relatively slight, and, except on the west coast of the South Island and in southern Otago, rainfall is generally light.

The most general rains during the month—namely, those of the 1st, 5th, and 28th—were associated with cyclonic depressions whose centres passed over the North Island. The last of these was the most severe. Its centre was located off the New South Wales coast on the 26th November, and by the morning of the 28th had reached the east coast of New Zealand just south of Napier. Southerly gales were experienced on the 28th and 29th in east-coast districts between East Cape and Lyttelton and in the central districts, and very low temperatures prevailed. In many places the gale was the worst experienced for a number of years, and cold and wind combined caused much damage to vegetation. There was also some loss of shorn sheep.

On the morning of the 24th an intense cyclone was centred off the south coast of New South Wales. During the next twenty-four hours it moved with extraordinary rapidity, so that by the next morning it was centred about Foveaux Strait. It affected chiefly districts south of New Plymouth and Castlepoint, strong north-westerly winds prevailing. Heavy rain fell in parts of the western districts.

The westerly type of weather prevailed from the 7th to the 13th and from the 17th to the 22nd.

The rainfall for the month exceeded the normal in all parts of the South Island except central and south-western Otago. In the North Island it was above normal southwards of Raglan and Napier, but below it in the Auckland Peninsula and the Bay of Plenty and Gisborne districts.

On the whole the month was a dull and wet one, with temperatures considerably below the November mean. In consequence the growth of crops, pastures, &c., was checked. Shearing also was delayed in some districts.

RAINFALL FOR NOVEMBER, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	1·84	11	0·50	3·27
Russell	0·98	4	0·56	2·26
Whangarei	1·30	8	0·65	3·00
Auckland	1·63	13	0·45	3·26
Hamilton	2·17	17	0·50	4·04
Kawhia	4·72	18	1·04	4·49
New Plymouth	7·16	18	1·69	4·61
Riversdale, Inglewood	11·44	18	2·42	8·95
Eltham	5·80	16	2·00	3·35
Whangamomona	8·25	13	2·15	7·40
Tairua	2·10	6	0·86	3·53
Tauranga	1·45	11	0·32	3·29
Maraehako Station, Opotiki ..	2·32	10	0·66	3·04
Gisborne	0·65	8	0·21	3·02
Taupo	3·47	8	0·73	3·41
Napier	1·37	9	0·37	2·51
Maraekakaho Station, Hastings ..	2·58	14	1·02	2·03

RAINFALL FOR NOVEMBER, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
North Island—continued.				
	Inches.		Inches.	Inches.
Taihape	5·19	20	1·31	3·69
Masterton	6·60	18	1·85	2·73
Patea	7·32	17	1·69	3·72
Wanganui	5·82	12	1·40	3·18
Foxton	5·08	15	0·84	3·24
Wellington	5·72	19	1·20	3·44
South Island.				
Westport	8·74	26	1·56	7·08
Greymouth	9·67	22	1·92	9·13
Hokitika	11·32	20	2·26	10·73
Ross	15·73	14	4·43	13·94
Arthur's Pass	13·68	14	4·23	15·50
Okura, Westland	7·98	8	1·94	12·96
Collingwood	10·82	17	2·48	7·68
Nelson	4·34	13	1·64	2·93
Spring Creek, Blenheim ..	3·57	15	1·35	2·42
Tophouse	5·65	22	0·92	6·62
Hanmer Springs	6·60	15	1·50	2·74
Highfield, Waiau	4·60	12	1·06	2·51
Gore Bay	5·24	20	1·70	2·05
Christchurch	3·06	19	1·08	1·87
Timaru	2·66	21	0·58	1·96
Lambrook Station, Fairlie ..	4·00	8	0·90	2·01
Benmore Station, Clearburn ..	2·66	12	0·64	2·05
Oamaru	2·64	10	0·68	1·93
Queenstown	1·28	11	0·33	2·74
Clyde	0·95	6	0·42	1·36
Dunedin	2·99	17	0·40	3·27
Wendon	3·67	17	0·73	2·54
Gore	4·01	23	0·81	3·31
Invercargill	5·30	21	0·75	4·40
Puysegur Point	5·25	23	0·75	8·36

Bush-sickness Control.—In his annual report for 1926–27 the Department's Chief Chemist (Mr. B. C. Aston) mentions that during the year a number of field experiments using iron compounds for top-dressing permanent pasture were inaugurated by Mr. R. E. R. Grimmett (then stationed at Rotorua), and in this way 10 tons of sulphate of iron were distributed to farmers in the affected districts to be used in co-operative experiment investigations with superphosphate, the farmers supplying the cattle themselves. The use of iron ammonium citrate has considerably increased; the action of the Department in supplying this drug to farmers at cost price has, judging from the sales, been much appreciated. Over a ton of this drug has been sold to farmers in small parcels of a pound or so at a time. Instructions for its proper use were published in the *Journal* for August, 1926.

Importation of Sausage-casings.—Regulations under the Stock Act, governing the importation of sausage-casings into New Zealand, were gazetted on 29th September. The main provision is one requiring that the casings in every shipment must be certified as derived from animals which had received ante-mortem and post-mortem veterinary inspection, and were found free from disease; further, that the casings were sound and fit for human consumption, and not treated with preservatives.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by Inspectors of Stock in the various districts. Corresponding figures for the five previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1927 ..	7,905,432	87·28	6,899,861	..
1926 ..	7,503,200	84·35	6,329,338	6,459,775
1925 ..	7,463,735	85·64	6,391,812	6,345,218
1924 ..	7,148,949	85·00	6,049,654	6,199,881
1923 ..	7,170,154	91·34	6,549,143	6,170,673
1922 ..	6,771,482	90·36	6,118,530	5,955,081
		SOUTH ISLAND.		
1927 ..	6,926,298	86·17	5,968,979	..
1926 ..	6,445,052	84·79	5,465,361	5,609,906
1925 ..	6,251,488	78·61	4,914,046	5,090,562
1924 ..	5,927,145	87·87	5,208,378	5,267,266
1923 ..	5,892,849	83·99	4,949,313	4,962,663
1922 ..	5,724,572	82·53	4,724,475	4,949,440
		DOMINION.		
1927 ..	14,831,730	86·76	12,868,840	..
1926 ..	13,948,252	84·57	11,794,699	12,069,681
1925 ..	13,715,223	82·43	11,305,858	11,435,780
1924 ..	13,076,094	86·14	11,258,032	11,467,147
1923 ..	13,063,003	88·02	11,498,456	11,133,336
1922 ..	12,496,054	86·77	10,843,005	10,904,521

—*Live-stock Division.*

PRECAUTIONS AGAINST SPREAD OF FIREBLIGHT.

REGULATIONS GOVERNING REMOVAL OF CERTAIN PLANTS AND BEES FROM NORTH ISLAND.

THE regulations under the Orchard and Garden Diseases Act published respectively in the *Gazette* of 18th June, 1920, and 28th May, 1925, governing the removal of certain plants and bees from the Auckland and North Auckland Land Districts, and the counties of Patea, Waitotara, and Wanganui, were revoked by Order in Council dated 6th June, 1927, and the following new regulations issued in lieu thereof:—

1. In these regulations "Plant" includes any portion of a plant, excepting fruit: "Disease" means the disease known as fireblight (*Bacillus amylovorus*).

2. No person shall send or bring any plant of any variety of apple, pear, quince, or cratœgus (hawthorns) from the North Island into any other portion of New Zealand: Provided that nothing in this regulation shall apply to the sending by an officer of the Department of Agriculture under proper safeguards of any plant of any of the above-mentioned kinds for the purpose of identification of disease.

3. (1) No person shall send or bring any package of trees or shrubs, or portions of trees or shrubs, from the North Island to any other portion of New Zealand unless such package is accompanied by a certificate, in the form set out in the Second Schedule hereto, signed by or on behalf of the consignor, stating that no plant or portion of a plant of any variety of apple, pear, quince, or cratœgus is contained in the package.

(2) The certificate shall be endorsed on a tag or label securely attached to the package in a prominent position.

(3) No person shall carry or despatch or deliver for purposes of despatch to any officer of the Post Office or the Railway Department or any other person any package containing trees or shrubs or portions of trees or shrubs intended to be sent from the North Island to any other portion of New Zealand, and not having attached thereto as herein provided the certificate required by this regulation.

4. (1) No person shall send or bring any bees from the North Island to any other portion of New Zealand unless such bees have been effectively quarantined at a place of quarantine as provided by this regulation for the six days immediately prior to their despatch from that Island, so as to prevent their having access to any flowers or other vegetation.

(2) The Director of the Horticulture Division of the Department of Agriculture shall appoint such places of quarantine within the North Island, and shall impose such conditions for their use, as he deems necessary.

(3) After completing the prescribed period of six days in quarantine the bees shall be forwarded direct from the place of quarantine to their final destination, an official permit in the form set out in the Third Schedule hereto or to the like effect, signed by an officer of the Department of Agriculture, being attached by tag or label to each parcel of such bees.

(4) No person shall carry or despatch or deliver for purposes of despatch to any officer of the Post Office or the Railway Department or any other person any package containing bees intended to be sent from the North Island to any other portion of New Zealand and not having attached thereto as herein provided the permit required by this regulation.

(5) All expenses of sending bees to a place of quarantine and of forwarding them on completion of their period of quarantine to their destination outside the North Island shall be borne by the original sender of such bees, and shall be payable on demand.

(6) The officer of the Department of Agriculture in charge of any place of quarantine may in his discretion, before accepting any bees intended to be dealt with under this regulation, require the person delivering the same to him to prepay to him the estimated expense of sending the same to their destination.

(7) Every person who does or omits any act in contravention of these regulations, or signs any certificate under these regulations which contains a false statement, commits an offence, and is liable on conviction to a fine not exceeding £20.

The regulations came into force on publication in the *Gazette* of 9th June, 1927, in which the several schedules may be seen.

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates, for the remainder of the current season, have been notified by agricultural and pastoral associations :—

Nuhaka A. and P. Association : Nuhaka, 1st January, 1928.
Marton District A. and P. Association : Marton, 18th January.
Waipukurau A. and P. Association : Waipukurau, 20th January.
Palmerston and Waihemo A. and P. Association : Palmerston, 20th January.
Horowhenua A. and P. Association : Levin, 24th and 25th January.
Tapanui Farmers' Club : Tapanui, 25th January.
Rangitikei A. and P. Association : Taihape, 25th and 26th January.
Helensville A. and P. Association : Helensville, 30th January.
Golden Bay A. and P. Association : Motupipi, 1st February.
Woodville A. and P. Association : Woodville, 3rd and 4th February.
Omaha and Pakiri A. and H. Association : Leigh, 4th February.
Clevedon A. and P. Association : Clevedon, 4th February.
Feilding A. and P. Association : Feilding, 7th and 8th February.
Te Puke A. and P. Association : Te Puke, 8th February.
Dannevirke A. and P. Association : Dannevirke, 8th, 9th, and 10th February.
Hikurangi-Otonga A. and P. Association : Hikurangi, 9th February.
Masterton A. and P. Association : Solway, 14th and 15th February.
Te Awamutu A. and P. Association : Te Awamutu, 15th February.
Taumarunui A. and P. Association : Taumarunui, 15th February.

Buller A. and P. Association: Westport, 17th and 18th February.
Ohura A. and P. Association: Matiere, 22nd and 23rd February.
Franklin A. and P. Association: Pukekohe, 24th and 25th February.
Tauranga A. and P. Association: Tauranga, 29th February.
Hukerenui Agricultural Association: Hukerenui, 1st March.
Mongonui County A. and P. Association: Kaitaia, 3rd March.
Opotiki A. and P. Association: Opotiki, 6th March.
Taranaki Agricultural Society: New Plymouth, 7th and 8th March.
Matamata A. and P. Association: Matamata, 13th March.
King-country Central A. and P. Association: Te Kuiti, 15th March.
Kaikoura A. and P. Association: Kaikoura, 16th March.
Hawke's Bay A. and P. Society: Autumn Show, Tomoana, 17th March.
Mayfield A. and P. Association: Mayfield, 17th March.
Hawarden A. and P. Association: Hawarden, 23rd March.
Methven A. and P. Association: Methven, 29th March.
Oxford A. and P. Association: Oxford, 5th April.

CROP AREAS AND YIELDS: SEASONS 1925-26 AND 1926-27.

Crop.	1925-26.		1926-27.	
	Area.	Yield per Acre.	Area.	Yield per Acre.
	Acres.		Acres.	
Wheat—				
Grain	151,673	30·44 bushels	220,083	36·13 bushels.
Chaff, &c. ..	857	1·35 tons	928	1·87 tons.
Oats—				
Grain	102,485	40·14 bushels	117,326	42·58 bushels.
Chaff, &c. ..	245,026	1·45 tons	255,372	1·70 tons.
Barley—				
Grain	25,969	36·47 bushels	29,886	41·60 bushels.
Chaff, &c. ..	370	2·14 tons	528	1·66 tons.
Maize—				
Grain	8,508	49·75 bushels	10,249	47·94 bushels.
Ensilage	557	3·01 tons	730	3·31 tons.
Peas and beans ..	11,749	24·48 bushels	15,495	29·35 bushels.
Linseed—Seed ..	8,143	0·29 ton	4,933	0·39 ton.
Rye-grass—Seed ..	45,154	456·77 lb.	42,082	424·45 lb.
Cocksfoot—Seed ..	9,745	173·90 lb.	9,820	189·21 lb.
Chewings fescue—Seed	6,902	228·12 lb.	9,634	225·98 lb.
Crested dogstail—Seed	2,679	174·96 lb.	9,307	159·26 lb.
Red clover and cow-grass—Seed	6,579	185·16 lb.	8,540	181·87 lb.
White clover—Seed ..	5,358	176·13 lb.	4,029	165·07 lb.
Other grasses and clovers—Seed	3,132	153·55 lb.	4,287	87·57 lb.
Grasses and clovers cut for hay	224,777	1·76 tons	288,455	1·90 tons.
Potatoes	23,484	6·09 tons	24,616	4·73 tons.
Green fodder crops ..	255,429	..	219,031	..
Turnips	468,475	..	462,360	..
Mangolds	13,296	..	11,870	..
Onions	514	8·73 tons	765	9·28 tons.
Hops	648	1,159·59 lb.	636	1,408·14 lb.

Correction.—In the statement of fertilizer importations printed on page 351 of last month's *Journal* the amount of sulphate of ammonia imported from the United Kingdom should have been 1 ton.

LIVE-STOCK IN NEW ZEALAND, 1927.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1926–27.	Number of Lambs tailed, 1926–27.	Sheep (including Lambs) as at 30th April, 1927.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	33,725	71	465,127	184,027	24,635	856,563	377,119	852,960	78,139	946	2,705
Auckland	44,862	2	716,077	321,022	22,505	1,103,057	560,639	1,049,451	158,984	1,017	3,266
Gisborne	18,349	38	274,516	26,161	5,986	2,893,188	1,237,714	3,071,806	12,771	633	2,209
Hawke's Bay ..	15,319	1	201,423	43,137	8,063	2,734,083	1,301,983	2,899,481	16,743	1,132	2,081
Taranaki	20,181	5	356,120	192,765	10,120	824,352	392,784	785,166	63,569	72	5,200
Wellington	40,487	31	637,750	178,451	19,893	5,094,919	2,589,536	5,389,895	75,586	708	763
Nelson	6,837	5	63,443	24,417	3,718	369,090	147,197	421,662	14,773	752	662
Marlborough	6,830	5	44,451	14,610	1,894	994,091	422,624	1,070,509	7,051	267	3,099
Westland	2,238	..	40,370	10,384	2,200	57,364	39,442	63,371	5,978	21	135
Canterbury	57,010	41	174,611	70,966	9,133	4,154,837	2,635,526	4,825,575	51,230	255	130
Otago	32,740	16	125,195	49,127	6,936	2,825,274	1,404,366	3,361,551	21,260	7	25
Southland	25,135	7	158,640	66,478	6,597	1,534,990	960,751	1,857,586	14,059	6	8
Dominion totals ..	303,713	222	3,257,729	1,181,545	121,680	23,441,808	12,069,681	25,649,016	520,143	5,816	20,283
Totals 1926 (or 1925–26)	314,867	161	3,452,486	1,181,441	122,415	22,686,200	11,435,780	24,904,993	472,534	4,945	16,816